

Anatomy Revision To Written exam

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Head & Neck

1. Mention skull Sutures.

= Enumerate skull sutures and their locations.

1. **Coronal suture** - unites the frontal bone with the parietal bones
2. **Sagittal suture** - unites the 2 parietal bones in the midline
3. **Lambdoid suture** - unites the parietal bones with the occipital bone
4. **Squamosal suture** - unites the squamous portion of the temporal bone with the parietal bones
5. **Metopic suture** - (if present) unites the 2 frontal bones.

2. Mention Para Nasal Sinuses (PNS).

DEF: The **paranasal sinuses** are pairs of air-filled cavities with variable morphologies located within the bones of the skull.

- **Frontal sinuses:** The right and left frontal sinuses are located in the center of the forehead (frontal bone) just above each eye.
- **Maxillary sinuses:** These are the largest of the sinuses and are located behind the cheekbones near the maxillae, or upper jaws.
- **Sphenoid sinuses:** located in the sphenoid bone near the optic nerve and the pituitary gland on the side of the skull.
- **Ethmoid sinuses:** located in the ethmoid bone, which separates the nasal cavity from the brain. These sinuses aren't single sacs but a collection of 6 to 12 small air cells that open independently into the nasal cavity.

3. Mention the nasal cavity.

The nasal cavity is a roughly cylindrical, midline airway passage that extends from the nasal ala anteriorly to the choana posteriorly

- It is divided in the midline by the nasal septum.
- On each side, it is flanked by the maxillary sinuses and roofed by the frontal, ethmoid, and sphenoid sinuses in an anterior to posterior fashion.
- Sino nasal anatomy is composed of air passages and drainage pathways that connect the sinuses.

4. Mention the orbits.

The orbits are two bony sockets at the front of the face that primarily house and protect the eyes and associated structures.

- The orbit Contents – globe – extraocular muscles – cranial nerves – arteries – veins – fat – lacrimal gland – fascia bulbi (Tenon's capsule).

Major Foramina of the Orbit and Their Neurovascular Contents
Optic Canal Optic nerve Ophthalmic artery
Superior Orbital Fissure Cranial nerves: III, IV, VI, V1 Lacrimal and frontal nerves Superior and inferior ophthalmic veins
Inferior Orbital Fissure Cranial nerve: V 2 Zygomatic nerve Infraorbital vessels

5. Mention Brain Meninges.

DEF: The brain meninges are thin layers of tissue found between the brain and the inner table of the skull.

The brain meninges comprise the **dura mater, the arachnoid, and the pia mater.**

1. The dura mater and arachnoid are an anatomical unit, only separated by pathological processes.
2. The falx cerebri and the tentorium cerebelli are thick infoldings of the meninges which are visible on CT imaging.

*Elsewhere the meningeal layers are not visible on CT as they are closely applied to the inner table of the skull.

6. Mention Brain parenchyma.

- The brain parenchyma consists of grey and white matter structures which are differentiated on CT by differences in density.
 - **White matter** has a high content of myelinated axons.
 - **Grey matter** contains relatively few axons and a higher number of cell bodies.
- *As myelin is a fatty substance it is of relatively low density compared to the cellular grey matter. White matter, therefore, appears blacker than grey matter.

7. Mention Grey matter structures.

- Important grey matter structures visible on CT images of the brain include:
 - **Cortex:** layer of grey matter formed in gyri (folds) over the entire brain surface
 - **Insula;** forms an inner surface of the cerebral cortex found deep to the Sylvian fissure.
 - **Basal Ganglia:** located deep to the insula ➤ Basal ganglia = lentiform nucleus + caudate nucleus.
 - **Thalamus:** located deep to the insula.

8. Mention White matter structures.

- The **internal capsules and corpus callosum** are clinically important white matter tracts.
- **Each internal capsule has an anterior limb and a posterior limb connected at the 'genu'.**
- Sagittal CT images show the corpus callosum as a midline structure arching from anterior to posterior.

8. Mention Posterior fossa.

=. Mention Structures filling posterior fossa.

- The posterior fossa accommodates the cerebellum and brain stem.
- ✓ Superiorly the cerebellum is separated from the cerebral hemispheres by the tentorium cerebelli.

10. Enumerate CSF spaces.

- The CSF spaces comprise **the sulci, fissures, basal cisterns and ventricles.**
- An appreciation of the normal appearances of the CSF spaces is required to allow assessment of brain volume.
- CSF is of lower density than the grey or white matter of the brain, and therefore appears darker on CT images.

11. Mention Ventricles in brain.

= Enumerate Parts of ventricular system in the brain.

✓ **Lateral ventricles:**

- The paired lateral ventricles are located on either side of the brain.
- The lateral ventricles contain the choroid plexus which produces CSF.
- Note : The choroid plexus is almost always calcified in adults.

✓ **Third ventricle.**

- The third ventricle is located centrally.
- The lateral ventricles communicate with the third ventricle via small holes (foramina of Monro).

✓ **Fourth ventricle.**

- The fourth ventricle is located in the posterior fossa between the brain stem and cerebellum.
- It communicates with the third ventricle above via a very narrow canal, the aqueduct of Sylvius (not shown)

• **Basal cisterns.**

- CSF in the basal cisterns surrounds the brain stem structures.

Function of CSF

12. Mention Function of CSF.

- 1- Physical support & protection of the CNS from trauma.
- 2- Supplying nutrients to the CNS & removal of metabolic wastes from CNS
- 3- Intra-cerebral transport
neuroendocrine role i.e. distribution of hypothalamic hormones within the brain.

13. Arterial supply of the brain.

* The brain is supplied by two systems of arteries:

1. vertebral system: consisting of a pair of vertebral arteries: unite at the lower border of the pons to form the basilar artery which ascends in the midline on the ventral surface of the pons and at its upper border terminates by dividing into right and left posterior cerebral arteries.

2. carotid system: consisting of a pair of internal carotid arteries.

- Each internal carotid artery ends in the region of anterior perforated substance by dividing into a larger middle cerebral artery, and a smaller anterior cerebral artery.

14. Circle of Willis.

DEF: six-sided polygon of arteries.

Site: is formed around the interpeduncular fossa and lies in the interpeduncular subarachnoid cistern.

Function: It contributes most of the arterial blood supply to the brain.

- **Circle of Willis is formed:**
 - **Anteriorly**, by the anterior communicating and the anterior cerebral arteries.
 - **Posteriorly**, by the basilar artery dividing into two posterior cerebral arteries.
 - **Laterally on each side**, by the posterior communicating artery connecting the internal carotid artery with the posterior cerebral artery.

15. Enumerate Dural venous sinuses.

- ✓ venous channels located intracranially between the two layers of the dura mater.

1. superior sagittal sinus
2. inferior sagittal sinus
3. straight sinus
4. transverse sinus
5. sigmoid sinus

16. Mention MR VENOGRAPHY (MRV).

- ✓ **MRV** is an MRI examination of the head with either contrast-enhanced or non-contrast sequences to assess patency of the dural venous sinuses and cerebral veins.

17 Mention skull bone structure on axial CT bone window image.

Cranial bones (8)

☼ Skull Cap (Calvarium):

- 1 Frontal
- 2 Parietal (R,L)
- 1 Occipital

☼ Skull Base (floor):

- 2 Temporal (R,L)
- 1 Sphenoid
- 1 Ethmoid

Facial bones (14)

- 2 Maxillary
- 2 Zygomatic
- 2 Lacrimal
- 2 Nasal
- 2 Palatine
- 2 Inferior nasal conche
- 1 Vomer
- 1 Mandible

18. Mention orbital spaces.

1. Intraconal
2. Extraconal
3. Conal

19. Enumerate brain lobes.

Right & Left:

1. Frontal lobe
2. Parietal lobe
3. Temporal lobe
4. Occipital lobe

20. Gray matter versus white matter on the axial CT brain.

- The brain consists of grey and white matter structures which are differentiated on CT by differences in density.
- White matter has a high content of myelinated axons (low density) so it looks more (Dark) Blacker than grey matter.
- Grey matter contains relatively few axons and a higher number of cell bodies (High density) so it looks less dark.

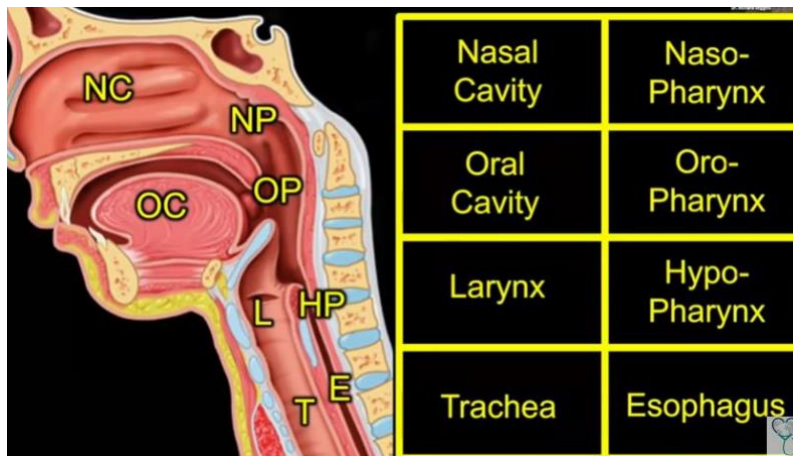
21. Enumerate anatomical parts of corpus callosum.

1. . Genu
2. Splenium
3. Rostrum

Q1: Neck anatomy.

1. Suprahyoid
2. Infrahyoid

Q2: Enumerate the Neck parts.



Q3: Enumerate the Larynx parts.

1. Supra-glottic Larynx
2. Glottic Larynx
3. Sub-glottic Larynx

- Supraglottis: extends from the tip of the epiglottis to the laryngeal ventricle
 - Epiglottis: divided into suprahyoid and infrahyoid portions
 - Pre-epiglottic space
 - Aryepiglottic folds
 - False vocal cords
 - Para-epiglottic space

- Glottis:
 - True vocal cords
 - Anterior commissure
 - Posterior commissure

- Subglottis:
 - extends from the inferior surface of the true vocal cords to the inferior aspect of the cricoid cartilage
 - Below this is the trachea

Q4: Enumerate the pharynx parts.

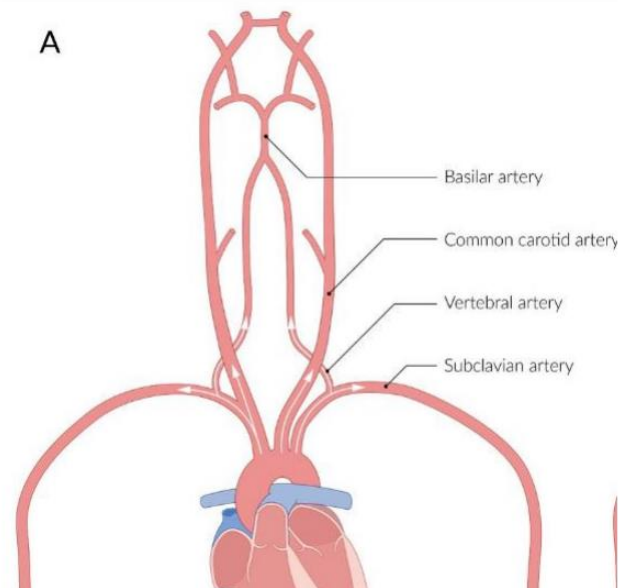
1. Naso- pharynx
2. Oro-pharynx
3. Hypo- pharynx

Hypopharynx consists of the pyriform sinuses, the lateral and posterior pharyngeal walls, and the posterior surfaces of the larynx extending to the cervical esophagus.

Tongue Base considered part of oropharynx

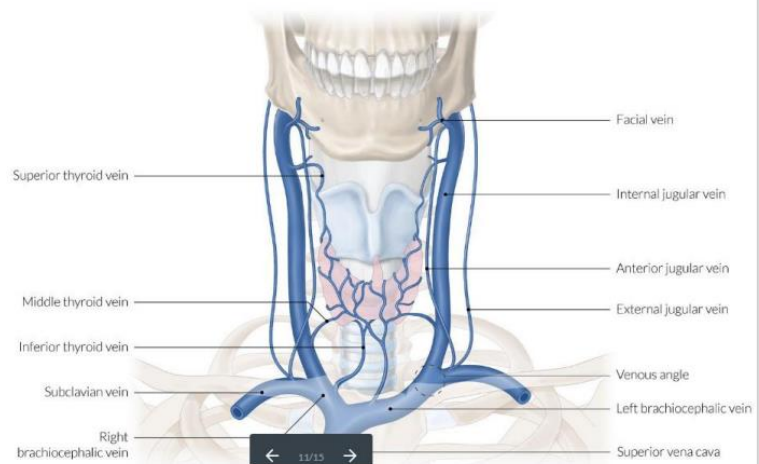
Q5: Enumerate Neck arteries supply.

1. Basilar artery
2. Vertebral artery
3. Common Carotid artery
4. Subclavian artery



Q6: Enumerate Neck Veins supply.

1. Facial vein
2. Superior & inferior & middle thyroid Vein
3. Anterior & internal & external jugular vein
4. Subclavian vein
5. Right & left brachiocephalic vein
6. SVC



Q7: Compare between

NASAL CAVITY	VS	NASOPHARYNX
Nostrils to posterior nasal aperture to cribriform plate		Posterior nasal aperture to clivus to soft palate
ORAL CAVITY	VS	OROPHARYNX
Includes anterior 2/3 tongue		Bottom of soft palate to top of epiglottis

Q8: Enumerate Floor of mouth parts.

1. Midline raphe
2. Mylohyoid muscle
3. Neurovascular bundle sublingual space

Chest & Heart

Q1: Mention Chest Bony skeleton.

= Mention bones contributing in the bony skeleton of the chest.

- Thoracic spine – 12 vertebrae
- Ribs
 - ✓ 12 pairs of ribs.
 - ✓ 1-7 connected to the sternum by costal cartilage
 - ✓ 8-10 articulate with ribs above and
 - ✓ 11&12 are free anteriorly.
- Sternum; Consists of:
 - ✓ Manubrium – provides articulation for clavicles 1st and upper part of 2nd ribs
 - ✓ Body articulates with 2nd–7th costal cartilages
 - ✓ Xiphoid process – remains cartilaginous
- Clavicle

Q2: Mention Chest wall layers.

- The chest wall extends from the skin to the parietal pleural.
- The chest wall can be divided into three layers:
 1. **superficial layer** of skin and subcutaneous fat.
 2. **Middle layer** containing the shoulder girdle and pectoralis muscles.
 3. **Deep layer** including the sternum, ribs, intercostal space, spine, fascia, and parietal pleural.

Q3: Write Short note about Diaphragm.

1. Separates the thorax from the abdomen.
2. The right hemidiaphragm is usually 1–1.5 cm higher than the left.
3. It arises from vertebral (RT< crus), costal and
4. sternal origins and from the central tendon .
5. **Three main openings:**
 - **Aortic – (T12)** – transmitting the aorta, thoracic duct and azygous vein
 - **esophageal (T10)** – esophagus, left gastric artery and vein and vagus
 - **Vena cava (T8)** – inferior vena cava and right phrenic.

Q4: Mention main openings of diaphragm.

Three diaphragm main openings:

Aortic – (T12) – transmitting the aorta, thoracic duct and azygous vein

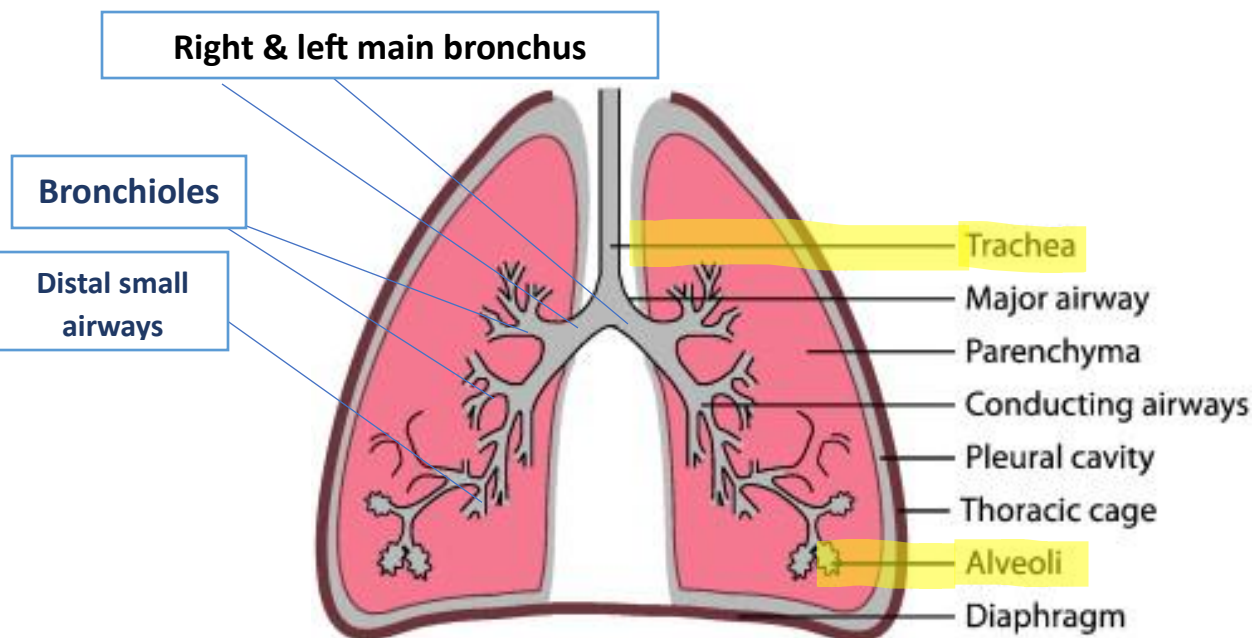
- **esophageal (T10)** – esophagus, left gastric artery and vein and vagus

- **Vena cava (T8)** – inferior vena cava and right phrenic.

Q5: Enumerate Airways of lung.

= Mention parts of airways with illustration.

• The airways consist of: ➤ The trachea ➤ Right & left main bronchus ➤ Bronchioles ➤ Distal small airways ➤ Alveoli



Q6: Write Short note about Trachea.

= Mention parts of airways with illustrations.

Trachea: is 9–12 cm in length.

- It commences at the level of the cricoid (c6)
- Bifurcates at the carina (t5), passing from them Midline to the right
- ✓ There are 12–16 incomplete cartilaginous rings.....open all time.
- ✓ **The trachea divides into the main bronchi at the carina:**
 1. **Right main bronchus**
 2. **Left main bronchus**

Q7: Mention Lobar anatomy of lungs.

- ✓ **Right lung** is larger than the left and **has 3 lobes (upper-middle-lower)**.
- ✓ **left lung** has **2 lobes (upper& lower)**.
- ✓ There are 10 segments in the right lung and 8 in the left and they are named after the bronchi.

Q8: Mention Pleura.

This is a thin continuous membrane consisting of:

- Parietal pleura – lines the non-pulmonary surfaces, including the diaphragm and pericardium and mediastinum.
- Visceral pleura – lines the pulmonary surfaces.

The two layers cannot be delineated on CT.

Q9: Mention pleural fissures.

The lobes of the lung are separated by pleural fissures.

➤ Right oblique (major) fissure

1. separates the right upper and middle lobe from the right lower lobe
2. runs from T5 through the hilum and contacts the diaphragm 3–4 cm posterior to the sternum.

➤ Left oblique fissure: separates the upper lobe from the lower lobe.

➤ Horizontal (minor) fissure:

1. separates the right upper lobe from the right middle lobe.
2. runs from the chest wall between the 4th and 6th rib to the intralobar artery at the hilum.

On CT : anterior area devoid of vessels.

Q10: Mention Pulmonary vessels.

1. Pulmonary artery:

- ✓ The **main pulmonary trunk** arises from the right ventricle & divides into a short left pulmonary artery and a longer right pulmonary artery.
- ✓ **Right pulmonary artery** runs between the superior vena cava and the right main stem bronchus and divides into 2 branches which supply the right lung lobes.
- ✓ **left pulmonary artery** arches over the left main bronchus and branches to supply left lung.

2. Pulmonary veins: There are two pairs of veins:

superior and inferior Pulmonary veins entering left atrium.

Q11: Enumerate divisions of main pulmonary artery.

- ✓ The **main pulmonary trunk** arises from the right ventricle & divides into a short left pulmonary artery and a longer right pulmonary artery .
- ✓ **Right pulmonary artery** runs between the superior vena cava and the right main stem bronchus and divides into 2 branches which supply the right lung lobes.
- ✓ **left pulmonary artery** arches over the left main bronchus and branches to supply left lung.

Q12: Mention Mediastinum compartments.

- Mediastinum extends from the sternum to the thoracic spine and from the inlet to the diaphragm. Radiologically the mediastinum may be divided into:
 1. **Superior Mediastinum.**
 2. **Inferior Mediastinum:**
 1. **Anterior** – Lying anterior to the pericardium, ascending Aorta and superior vena cava.
 2. **Middle** – contains, heart, great vessels and the hilum and carina.
 3. **Posterior** – retrocardiac and paravertebral spaces and contains descending aorta, esophagus, azygous system and spinal column.

Q13: Enumerate Heart chambers.

Right atrium	Left atrium
<ul style="list-style-type: none">• superior (SVC) and inferior vena cava (IVC) enter the right atrium at the superior and inferior extremities of the posterior wall respectively.• The opening of the coronary sinus (CS) is located along the posterior wall between the IVC and the tricuspid valve.	<ul style="list-style-type: none">• The most posterior and cranially situated chamber.• The left atrioventricular valve is the mitral valve.• The chamber has a thin muscular wall and is divided from the right atrium by the inter-atrial septum.• Typically, four pulmonary veins (left and right superior and inferior veins) drain into the LA.

Right ventricle	Left ventricle
<ul style="list-style-type: none">• The right ventricle (RV) is the most anterior cardiac chamber. It is relatively thin walled than the left ventricle.• It contains anterior, posterior and medial papillary muscles. The papillary muscle has chordae tendineae that attach to cusps of the tricuspid valve.	<ul style="list-style-type: none">• The left ventricular myocardium is considerably thicker than the right ventricular myocardium.• As a result of this and the pressure gradient between the right and left ventricles, the interventricular septum bulges slightly into the right ventricle.• The chordae tendineae arising from the anterior and posterior papillary muscles attach to the anterior and posterior mitral valve leaflets.

Q14: Mention the Heart layers.

1. **Pericardium layer** encases the heart, main pulmonary artery, ascending aorta, superior and inferior vena cava and the pulmonary veins. It is **made up of**:
 1. **outer fibrous pericardium** helps support the heart within the mediastinum.
 2. **inner serous pericardium** is composed of the visceral and parietal layers.
2. **Visceral layer (epicardium)** covers the heart and great vessels and is reflected into the parietal layer, which in turn forms the inner lining of the fibrous pericardium.

*NOTE:

- **Pericardial cavity** is the space between the visceral and parietal layers of the serous pericardium and contains 15–50 ml of clear fluid normally.
- **Normal pericardium** is visualized on CT and MR as a thin linear structure.

Q15: Mention Great veins of mediastinum.

- **Right and left brachiocephalic veins** are located anterior to the arch vessels.
- **Right brachiocephalic vein** has a vertical course and lies anterior and to the right of the trachea.
 - **left brachiocephalic vein** follows a more horizontal course.
- **superior vena cava (SVC)** is formed by the confluence of the two brachiocephalic veins.

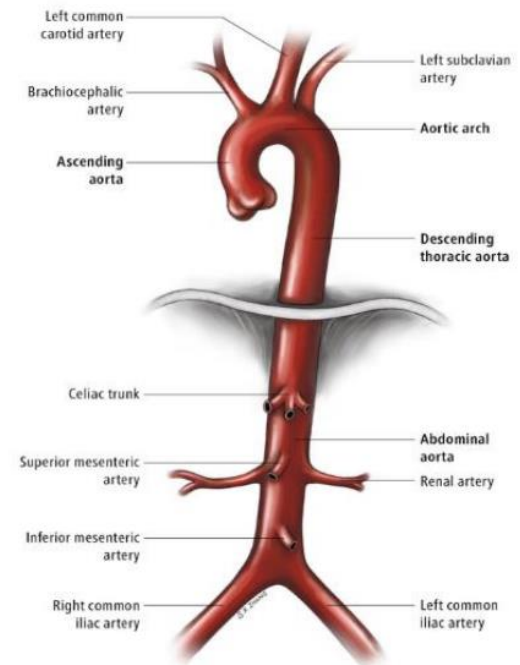
The SVC lies to the right of the aortic arch and drains into the right atrium.

Q15: Enumerate Small veins of mediastinum.

- ✓ **four pulmonary veins drain into the left atrium.**

Q16: Enumerate Arteries of mediastinum.

1. **Aorta**
2. **Right & Left Common carotid artery**
3. **Right & Left Subclavian artery**
4. **Brachiocephalic Trunk (only in Right)**
5. **Pulmonary artery**



Q17: Mention Aortic parts.

1. **Aortic root** – The first few centimeters of aorta from its valve to just above the coronary sinuses is the aortic root and this segment is invested within the pericardium.
2. **Ascending aorta**: courses upwards, anteriorly and to the right for a distance of approximately 5 cm, where it becomes the aortic arch .
3. **Aortic arch**: runs posteriorly from right to left .
At first it lies anterior to the trachea and esophagus, then over the pulmonary trunk and left main bronchus to a position left of the fourth dorsal vertebral body.
· Beneath the arch the pulmonary trunk bifurcates and the right pulmonary artery passes to the right under the arch.
· **In 65% the major vessels arising from the arch are:**
 1. **brachiocephalic trunk**, which subsequently divides into the right common carotid and right subclavian arteries.
 2. **left common carotid artery**
 3. **left subclavian artery.**
4. **Descending aorta**: Passes down the posterior mediastinum to the aortic hiatus of the diaphragm at the level of T12.

= Q17: Enumerate parts of Aorta.

• Aortic root • Ascending aorta • Aortic arch • Descending aorta.

Q18: Enumerate major vessels arising from the Aortic arc.

1. **brachiocephalic trunk**, which subsequently divides into the right common carotid and right subclavian arteries
2. **left common carotid artery**
3. **left subclavian artery.**

Q19: Write short note about Main Pulmonary Trunk.

- ✓ The **main pulmonary trunk (MPT)** is the continuation of the right ventricular outflow tract separated by the pulmonary valve.
- ✓ The MPT **bifurcates into right (RPA) and left (LPA) pulmonary arteries.**

Q20: Enumerate veins forming SVC.

- ✓ SVC is formed by the confluence of the two brachiocephalic veins (R-L).

Q21: Enumerate chambers of heart.

1. **Right atrium**
2. **Right ventricle**
3. **Left atrium**
4. **Left ventricle**

Abdomen & Kidney

Note: Liver is Largest/heaviest solid organ in the body (1.5 kg).

Q1: Mention Segmental anatomy of liver.

- Nine segments (segments I–III, IVa and IVb, V–VIII)
 - caudate lobe = segment I
 - portal and hepatic veins used as landmarks to divide the remainder of the liver into eight segments.
 - The three (left, middle and right) hepatic veins divide the liver into four sections.
 - The portal veins divide each of these into superior and inferior segments, a total of eight.

Q2: Mention blood supply of livers.

1. **Arterial:** dual blood supply: hepatic artery and portal vein.
 - **Hepatic artery:** provides 15% of hepatic blood supply – branch of coeliac artery.
 - **Portal vein:** provides 85% of blood supply to liver – formed by union of the splenic vein and superior mesenteric vein (SMV) posterior to neck of pancreas at L1/L2.
2. **Venous drainage of the liver** is via the hepatic veins: · unite to drain into the IVC at T9 close to the diaphragmatic hiatus.
 - ❖ caudate lobe drains directly into the IVC.

Q3: Write short note about GALLBLADDER.

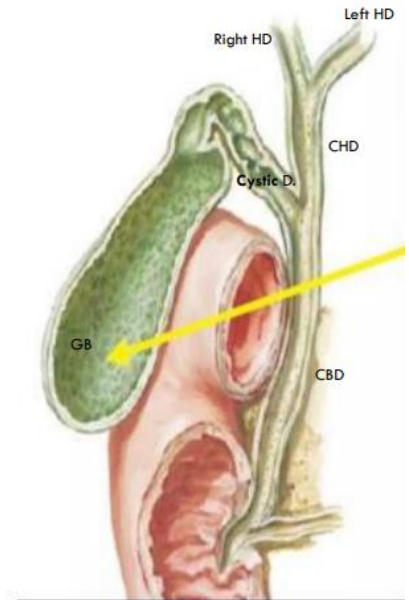
- Gallbladder is pear-shaped sac.
- hangs down from inferior surface of liver
- Parts: fundus usually anterior and inferior to the body and neck.
- It has cystic duct that arises from neck –& runs along liver surface to the porta hepatis.

Q4. Enumerate gallbladder parts.

1. fundus in anterior
2. body and neck in inferior

Q5. Mention Biliary tree.

1. **left and right hepatic ducts** unite to form the **common hepatic duct (CHD)** at the porta hepatis.
2. The CHD is joined by the **cystic duct** to form the **Common hepatic duct (CBD)**.



Note: MRCP use to see Gallbladder and biliary tree.

Q6. Write short note about Pancreas.

- The pancreas is Long epigastric gland extending from duodenal loop to splenic hilum.
- Similar density to liver on CT, but becomes atrophic and fatty with age.
- It Comprises the head, neck, body and tail.

Q7. Enumerate Pancreas parts.

- **head , neck, body and tail.**

Q8. Write short note about Spleen.

- Spleen is Largest lymphoid mass in the body.
- On non-enhanced CT spleen is homogeneous and has an attenuation of 35–55 HU, i.e. 5–10 HU less than that of liver.
- The spleen normally enhances heterogeneously immediately after injection of a bolus of contrast material on CT and MRI. Only after a minute or more does the splenic parenchyma achieve uniform homogeneous enhancement .

- adult spleen measures approximately 12–15 cm length, 4–8 cm in anteroposterior .
- Positioned in the left upper quadrant adjacent to 9th–11th ribs and has a diaphragmatic and visceral surface accessory or splenules present in 10%

Q9: Mention Blood supply of Spleen.

- Arterial supply from the splenic artery.
- Drainage via the splenic vein, which runs behind the pancreas to join the superior mesenteric vein at the pancreatic neck, forming the portal vein.

Q10: Enumerate GIT parts.

1. Pharynx.....Neck
2. Esophagus.....Chest And Upper Abdomen (Gastroesophageal Junction)
3. Stomach.... Abdomen
4. Small Intestine.... Abdomen
5. Large Intestine.... Abdomen

Q11: Enumerate regions of stomach.

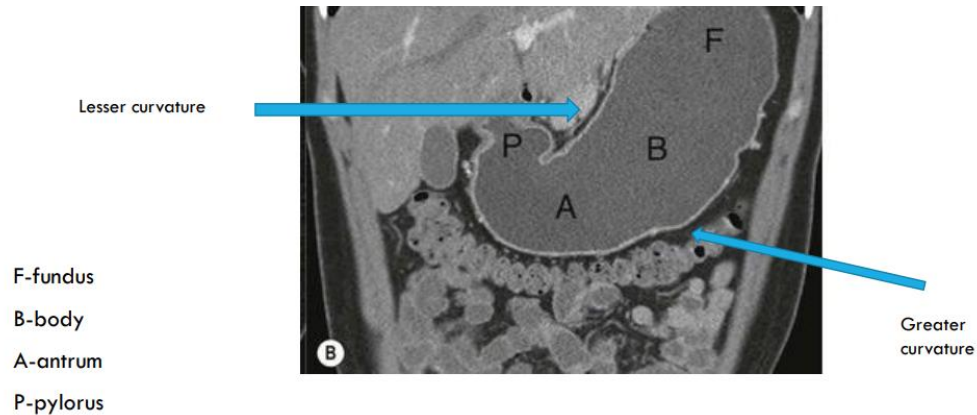
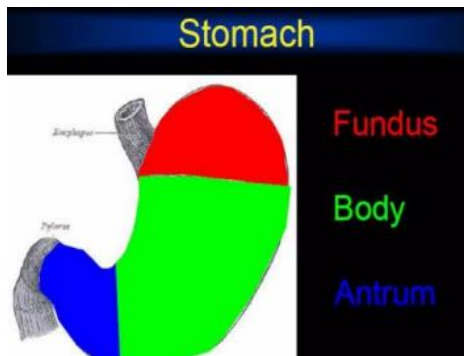
1. cardia (Gastro-esophageal Junction)
2. fundus
3. body (corpus)
4. pylorus (antrum)

Q12: Mention Regions of stomach.

- The stomach ("normal" empty volume 45 mL) is divided into distinct regions:
 - 1-cardia:** the area that receives the esophagus (gastro-esophageal junction).
 - 2-fundus:** formed by the upper curvature; portion of stomach above GEJ level 17.

3-body (corpus): the main central region of the organ; central two-thirds portion from the cardia to the incisura angularis 17.

4-pylorus (antrum): the lower section of the stomach that facilitates emptying into the small intestine, located on the right of the midline at the level of L1.



Q13: Enumerate the Small intestine parts.

1. Duodenum
2. Jejunum
3. Ilium

Q14: Enumerate the Large intestine parts.

1. Appendix
2. Cecum
3. Ascending colon
4. Transverse colon (in right: Hepatic flexure & in left: Splenic flexure)
5. Descending colon
6. Sigmoid colon
7. Rectum
8. Anal canal

Q15: Write short note about The kidneys.

- ✓ The kidneys are bilateral organs placed retroperitoneally in the upper left and right abdominal quadrants and are part of the urinary system. between the T12 and L4 vertebral bodies.
- The right kidney is more inferior, as it is displaced by the liver.
- Their shape resembles a bean, where we can describe the superior and inferior poles
- Both kidneys lie obliquely:
 - in the coronal plane, the upper pole is medially orientated ·
 - in the sagittal plane, the upper pole faces more posteriorly ·
 - in the axial plane, the medial aspect (or the renal pelvis) faces anteromedially.

Q16: Mention structure of kidney.

1. **Renal Cortex** that lies under the capsule of the kidney & It contains the top portion of the nephrons (i.e. the glomerulus as well as proximal and distal tubules).
2. **Renal Medulla** Is subdivided into cone-shaped renal pyramids, the outer portion of which border the renal cortex and the inner tip of which empty into the minor calyces.
3. **Renal Hilum:** structures entering or exiting: renal vein - renal artery - ureter - lymphatic and nerve fibers - fat (renal sinus fat).

Q17: Mention structures passing through renal hilum.

1. renal vein
2. renal artery
3. ureter lymphatic and nerve fibers
4. fat (renal sinus fat)

Q18: Mention blood supply of the kidney.

1. **Renal artery** is Most commonly a single renal artery arising from the abdominal aorta, at L1/2 interspace.
 1. **Right renal artery**: · longer than left · downward course and passes posterior to the inferior vena cava.
 2. **Left renal artery**: · arises higher than the right renal artery · has a more horizontal orientation. •
2. **Renal vein**: drains into IVC.
 - The **left renal vein** is three times longer than the **right renal vein**.

Q19: Write short note about the URETER.

- **Ureter Connects the renal pelvis to the bladder, and is 25–30 cm long.**
- **Relations:**
 - posterior – psoas muscle, genitofemoral nerve, sacroiliac joint and common iliac vessels, tips of the transverse processes of L2–L5 lumbar vertebrae
 - • anterior – right – duodenum, gonadal and colic artery – left – gonadal and colic artery, sigmoid mesentery.

Q20: Mention posterior relations of ureter.

- ✓ psoas muscle, genitofemoral nerve, sacroiliac joint and common iliac vessels, tips of the transverse processes of L2–L5 lumbar vertebrae.

Q21: Mention Anterior relations of ureter.

- ✓ right – duodenum, gonadal and colic artery – left – gonadal and colic artery, sigmoid mesentery.

Q22: Enumerate Major Abdominal Aorta branches.

- 5 Major Branches
 - Celiac Trunk
 - Superior Mesenteric Artery
 - Renal Arteries
 - Inferior Mesenteric Artery
 - Iliac Arteries

Q23: Mention Major Abdominal Aorta branches

1. **Coeliac artery:** is A large, unpaired visceral artery arising anteriorly at the level of T12.
 - It is also known as the celiac trunk and supplies the liver, stomach, abdominal esophagus, spleen, the superior duodenum and the superior pancreas.
2. **Superior mesenteric artery:** is A large, unpaired visceral artery arising anteriorly, just below the celiac artery.
 - ✓ It supplies the distal duodenum, jejunum-ileum, ascending colon and part of the transverse colon.
 - ✓ It arises at the lower level of L1.
3. **Inferior mesenteric artery:** A large, unpaired visceral artery that arises anteriorly at the level of L3.
 - ✓ It supplies the large intestine from the splenic flexure to the upper part of the rectum.
4. **Renal arteries:** Paired visceral arteries that arise laterally at the level between L1 and L2. They supply the kidneys.

Q24: Mention Abdominal veins.

- The systemic venous transports deoxygenated blood to the right atrium of the heart.

The major vessel in this system is the inferior vena cava.

- The **inferior vena cava** is the common convergence of venous drainage from all structures below the diaphragm. It is located on the posterior abdominal wall; anteriorly to the vertebral column and to the right of the abdominal aorta.
- The vessel is formed by the union of the common iliac veins at the L5 vertebral level. It ascends superiorly, and leaves the abdomen by piercing the central tendon of the diaphragm at the T8 level (the cava hiatus).

- ✓ Within the thorax, the inferior vena cava drains into the right atrium of the heart.

•Q25: Mention Tributaries that IVC receives it.

- The inferior vena cava is responsible for the venous drainage of all abdominal structures & it receives tributaries from:
 - Common iliac veins – formed by the external and internal iliac veins. They drain the lower limbs and gluteal region.
 - Lumbar veins – drain the posterior abdominal wall.
 - Renal veins – drain the kidneys, left adrenal gland and left testis/ovary.
 - Right testicular or ovarian vein – drains the right testes in males and the right ovary in females (the left testicular or ovarian vein drains into the left renal vein).
 - Right suprarenal vein – drains the right adrenal gland (the left adrenal vein drains into the left renal vein).
 - Inferior phrenic veins – drain the diaphragm.
 - Hepatic veins – drain the liver.

1. ABDOMINAL AORTA
2. INTERNAL ILIAC ARTERY
3. EXTERNAL ILIAC ARTERY
4. LUMBAR ARTERY
5. COMMON FEMORAL ARTERY
6. COMMON ILIAC

Note: The adrenal gland Paired retroperitoneal glands, supero-medial to the kidneys.

Q29: Mention Peritoneum.

- The peritoneum is a continuous membrane which lines the abdominal cavity and covers the abdominal organs (abdominal viscera).
- The peritoneum consists of two layers that are continuous with each other: the parietal peritoneum and the visceral peritoneum.
 - Peritoneal Cavity The peritoneal cavity is a potential space between the parietal and visceral peritoneum. It normally contains only a small amount of lubricating fluid.

Q30. Mention Intraperitoneal Organs and Retroperitoneal organs.

- **Intraperitoneal Organs** are enveloped by visceral peritoneum, which covers the organ both anteriorly and posteriorly. Examples include **stomach, liver and spleen**.
- **Retroperitoneal organs** are not associated with visceral peritoneum; they are only covered in parietal peritoneum, and that peritoneum only covers their anterior surface. e.g. (**Suprarenal (adrenal) Glands, Aorta/IVC, Duodenum, Pancreas, Ureters Kidneys, Rectum**).

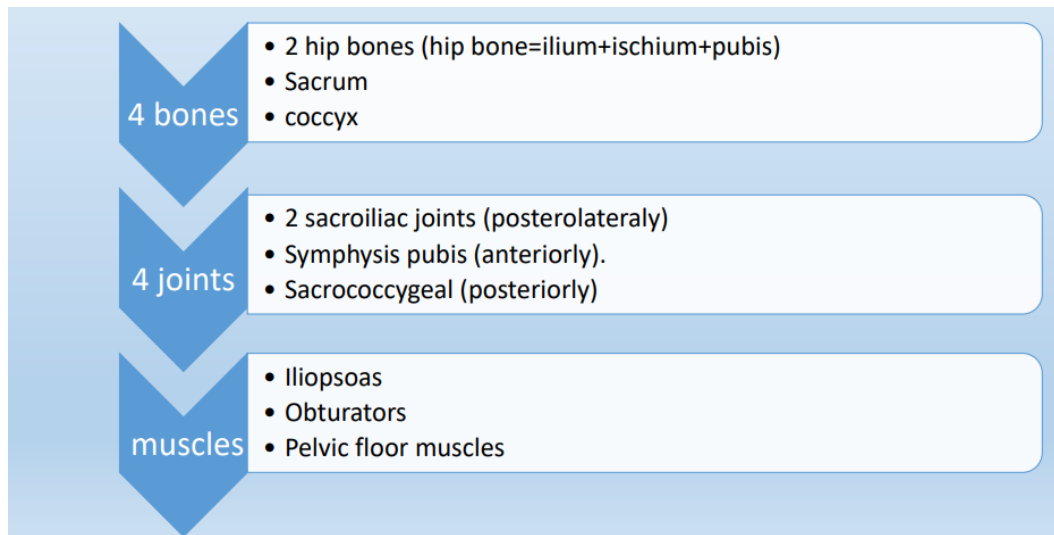
Q31: Enumerate Intraperitoneal Organs.

stomach, liver and spleen.

Q32: Enumerate Retroperitoneal Organs.

Suprarenal (adrenal) Glands, Aorta /IVC, Duodenum ,Pancreas, Ureters Kidneys, Rectum.

Q1: Enumerate Pelvis bones & Joints & Muscles.



Q2: Mention Bounds of false pelvis.

The False pelvis is bounded by:

Posteriorly:

Lumbar vertebrae.

Laterally:

Iliac fossae and the iliacus muscle.

Anteriorly:

Lower part of the anterior abdominal wall.

It supports the abdominal contents.

Q3: Mention The pelvis parts.

The pelvis is divided into two parts by the **pelvic brim**.

Above the brim is the **False or greater pelvis**, which is part of the abdominal cavity. Below the brim is the **True or lesser pelvis**.

Q4: Mention Male reproductive organs.

• The male reproductive system is made up of internal (inside body) and external (outside body) parts:

1. Internal parts:

- **Prostate gland** located below the urinary bladder in front of the rectum. .
- **Seminal vesicles** (sac-like pouches that attach to the vas deferens near the base of the bladder).
- **Vas deferens** (long, muscular tube that travels from the epididymis into the pelvic cavity, to just behind the bladder) .
- **Ejaculatory ducts.**
- **Urethra:** tube that carries urine from the bladder to outside of your body. (prostatic – membranous-bulbar-penile).

Q5: Enumerate External parts of male reproductive organs.

1. Testis
2. Epididymis
3. Spermatic cord
4. Penis

Q6: Enumerate internal parts of male reproductive organs.

1. Prostate gland
2. Seminal vesicles
3. Vas deferens
4. Ejaculatory ducts.
5. Urethra: (prostatic – membranous -bulbar -penile).

Q7: Enumerate parts of male urethra.

1. Prostatic Urethra
2. Membranous Urethra
3. Bulbar Urethra
4. Penile Urethra

Q8: Mention Female genital tract.

- **Vagina:** is located between the urethra, the bladder, and the rectum.
10-cm-long muscular tube.
- **Uterus:** The main parts of the uterus are the corpus (body), fundus, isthmus, and cervix.

The uterine corpus is composed of three layers:

1. **Endometrium:** the inner mucosal layer, whose thickness depends on age and hormonal status.
 2. **Myometrium:** the middle muscular layer, separated from the endometrium by a very thin junctional zone (the inner myometrium).
 3. **Perimetrium:** a thin peritoneal layer.
- **Fallopian tubes:** (uterine tube, salpinx) are each approximately 10 to 14 cm long
 - Each of the paired fallopian tubes arises from a superiorly tapered extension of the uterine cavity.
 - The narrow proximal tubal segment, called the isthmus, widens laterally to form the ampulla before terminating at the fimbriated end close to the ovary.
 - An open communication exists between the fallopian tube and the abdominal cavity.
 - **Ovaries:** are paired gonads located within the ovarian fossa on the lateral wall of the lesser pelvis (within the bifurcation of the common iliac artery).
 - **Structures in close relation to the ovary are** the obturator nerve, ureter, external iliac vein, internal iliac artery and vein, umbilical artery, and obturator artery.
 - Each ovary measures approximately 4 cm × 2 cm × 1 cm, has an ovoid shape.
 - Each ovary has follicles in different sizes.

Q9: Enumerate the main parts of the uterus.

corpus (body), fundus, isthmus, and cervix.

Q10: Mention The uterine corpus layers.

1. **Endometrium:** the inner mucosal layer, whose thickness depends on age and hormonal status.
2. **Myometrium:** the middle muscular layer, separated from the endometrium by a very thin junctional zone (the inner myometrium).
3. **Perimetrium:** a thin peritoneal layer.

Q11: Structures in close relation to the ovary

1. obturator nerve
2. obturator artery
3. external iliac vein
4. internal iliac artery and vein
5. umbilical artery
6. ureter

Q12: Compare between:

Organ	Testis	Ovaries
Shape	oval organs	Paired gonads
Site	<ul style="list-style-type: none">lie in the scrotum.secured at either end by a structure called the spermatic cord.	<ul style="list-style-type: none">Located:<ol style="list-style-type: none">1. within the ovarian fossa .2. on the lateral wall of the lesser pelvis.3. within the bifurcation of the common iliac artery.

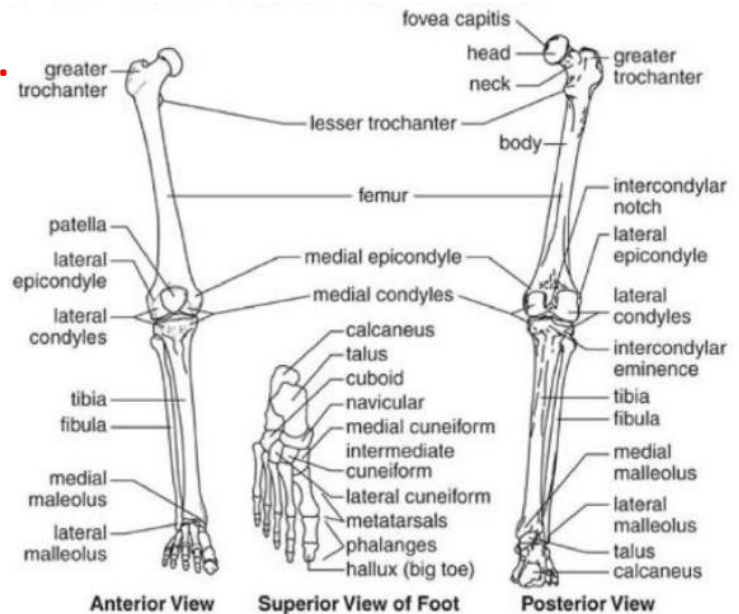
Q13: Mention parts of fallopian tubes.

1. Isthmus
2. Ampulla
3. Infundibulum
4. Fimbria

Lower limb

Q1: Enumerate lower limb Bones.

- Pelvis
- Femur
- Leg bones: Tibia & Fibula
- Patella = Knee cap
- Foot bones:
 1. Tarsals
 2. Digits:
 - Meta-tarsals
 - Phalanges



Q2: Enumerate lower limb Joints.

- | | | |
|---|--|---|
| <ol style="list-style-type: none"> 1. Hip joint 2. Knee joint 3. Ankle joint 4. Foot joints | <ul style="list-style-type: none"> ■ Hip (femur + acetabulum) <ul style="list-style-type: none"> ■ Ball + socket ■ Multiaxial ■ Synovial ■ Knee (femur + patella) <ul style="list-style-type: none"> ■ Plane ■ Gliding of patella ■ Synovial ■ Knee (femur + tibia) <ul style="list-style-type: none"> ■ Hinge ■ Biaxial ■ Synovial | <ul style="list-style-type: none"> ■ Proximal Tibia + Fibula <ul style="list-style-type: none"> ■ Plane ■ Gliding ■ Synovial ■ Distal Tibia + Fibula <ul style="list-style-type: none"> ■ Slight "give" ■ Fibrous ■ Ankle (Tibia/Fibula + Talus) <ul style="list-style-type: none"> ■ Hinge ■ Uniaxial ■ Synovial |
|---|--|---|

Q3: Enumerate lower limb MUSCLES.

1. Compartments in thigh
2. Leg muscles

Q4: Enumerate lower limb Fascia.

1. Superficial Fascia
2. Deep fascia
3. Fascia Lata

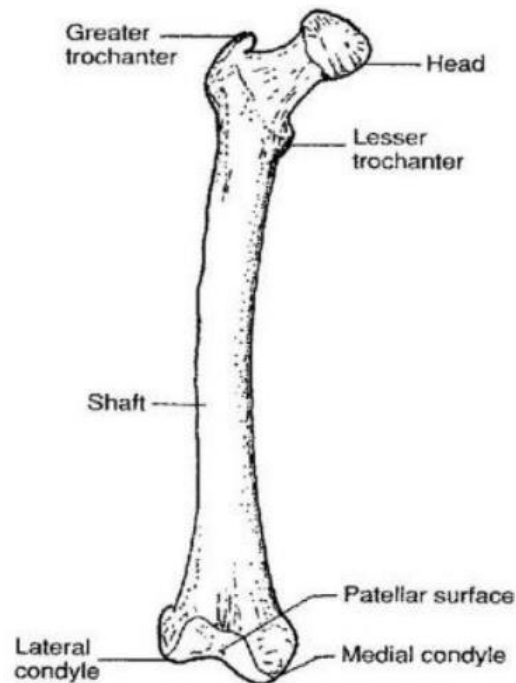
Q5: Write short note about Femur.

Femur

The femur is the longest and largest bone.

There are four eminences, or protuberances, in the femur: the head, the greater trochanter, the lesser trochanter, and the lower extremity.

The shaft of femur is cylindrical with a rough line on its posterior surface (linea aspera).



Q6: Write short note about Patella.

• **Patella**

- Triangular sesamoid bone
- Protects knee joint
- Improves leverage of thigh muscles acting across the knee
- Contained within patellar ligament

Q7: Write short note about Tibia & Fibula.

= Compare between Tibia & Fibula.

= Mention Leg bones.

- **Tibia**

- Receives the weight of body from femur and transmits to foot
- Second to femur in size and weight
- Articulates with fibula proximally and distally
 - Interosseous membrane

- **Fibula**

- Does NOT bear weight
- Muscle attachment
- Not part of knee joint
- Stabilize ankle joint

Q8: Mention foot function.

- **Function:**
 - Supports the weight of the body
 - Act as a lever to propel the body forward

Q9: Mention foot Parts.

- **Parts:**
 - **Tarsals**
 - **Talus** = ankle
 - Between tibia and fibula
 - Articulates with both
 - **Calcaneus** = heel
 - Attachment for Calcaneal tendon
 - Carries talus
 - **Navicular**
 - **Cuboid**
 - Medial, lateral and intermediate cuneiforms
 - **Metatarsals**
 - **Phalanges**

Q10: Enumerate Tarsals.

- 1- Medial cuneiform bone
- 2- Intermediate cuneiform bone
- 3- Lateral cuneiform bone
- 4- Cuboid bone
- 5- Navicular bone
- 6- Calcaneal bone
- 7- Talus



Q11: Mention Hip joint.

Hip Joint

- **Articulation**- between head of femur and acetabulum.
- **Type**- Synovial ball and socket joint.
- **Capsule**- encloses the joint. Medially- attached to acetabular labrum. Laterally- attached to intertrochanteric line of femur in front and half way along posterior aspect of neck behind.

Q12: Mention Structure of hip joint.

1-Articulating Surfaces:

- The hip joint consists of an **articulation between the head of femur and acetabulum of the pelvis.**
 - ✓ **Acetabulum:**
 - is a cup-like depression located on the inferolateral aspect of the pelvis.
 - Its cavity is deepened by the presence of a fibrocartilaginous collar – the acetabular labrum.
 - ✓ **Head of femur** is hemispherical, and fits completely into the concavity of the acetabulum.
- Both the acetabulum and head of femur are covered in articular cartilage, which is thicker at the places of weight bearing.

2-The capsule of the hip joint:

- **Proximally:** attaches to the edge of the acetabulum.
- **Distally:** attaches to the intertrochanteric line anteriorly and the femoral neck posteriorly.
- ✓ **3-The ligaments of the hip joint** act to increase stability & They can be divided into two groups – **intracapsular and extracapsular ligaments.**

Q13: Mention articulating surfaces forming hip joint.

- The hip joint consists of an **articulation between the head of femur and acetabulum of the pelvis.**
 - ✓ **Acetabulum:**
 - is a cup-like depression located on the inferolateral aspect of the pelvis.
 - Its cavity is deepened by the presence of a fibrocartilaginous collar – the acetabular labrum.
 - ✓ **Head of femur** is hemispherical, and fits completely into the concavity of the acetabulum.
- Both the acetabulum and head of femur are covered in articular cartilage, which is thicker at the places of weight bearing.

Q14: Write short note about Knee Joint.

- ✓ Knee Joint is hinge type synovial joint, which mainly allows for flexion and extension.
- ✓ It is formed by articulations between the patella, femur and tibia.

Q15: Mention articulating surfaces forming knee joint.

- The joint surfaces are lined with hyaline cartilage and are enclosed within a single joint cavity.
- **The knee joint consists of two articulations:**
 - 1. Tibiofemoral:**
 - Medial and lateral condyles of the femur articulate with the tibial condyles.
 - It is the weight-bearing component of the knee joint.
 - 2. Patellofemoral:**
 - Anterior aspect of the distal femur articulates with the patella.
 - It allows the tendon of the quadriceps femoris (knee extensor) to be inserted directly over the knee – increasing the efficiency of the muscle.

Q16: Mention Menisci Function.

= Mention functions of fibrocartilage structures in the knee joint.

- The medial and lateral menisci are fibrocartilage structures in the knee that serve two functions:
 1. To deepen the articular surface of the tibia, thus increasing stability of the joint.
 2. To act as shock absorbers by increasing surface area to further dissipate forces.

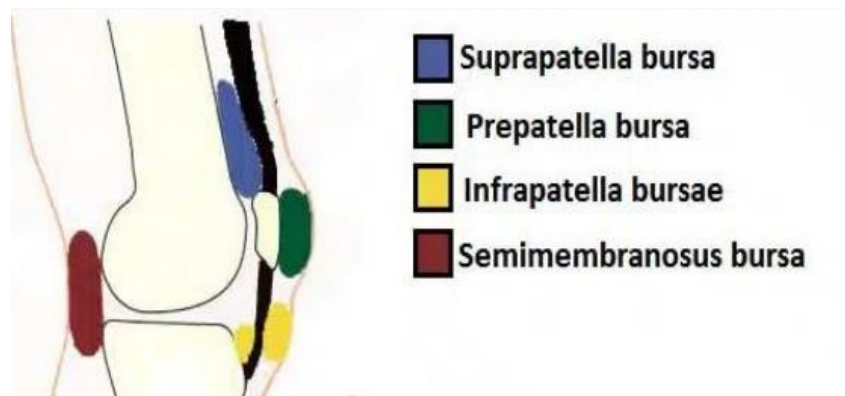
Q17: Mention intercondylar attachment in Knee joint.

- Medial And Lateral Menisci are fibrocartilage structures in the knee and they are C shaped and attached at both ends to the intercondylar area of the tibia.
- In addition to intercondylar attachment:
 1. **Medial meniscus** is fixed to the tibial collateral ligament and the joint capsule.
 - Damage to the tibial collateral ligament usually results in a medial meniscal tear.
 2. **lateral meniscus** is smaller and does not have any extra attachments, rendering it fairly mobile.

Q18: Enumerate Bursae around the knee.

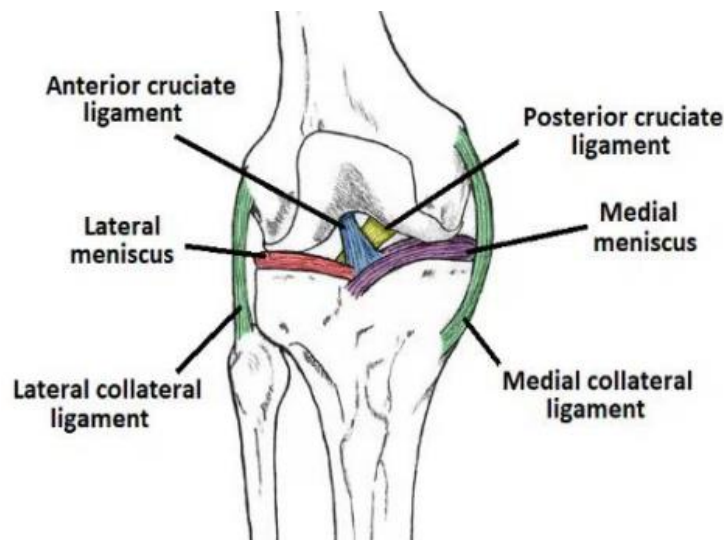
- A bursa is synovial fluid filled sac, found between moving structures in a joint – with the aim of reducing wear and tear on those structures.
- There are four bursae found in the knee joint:

1. Supra-Patella bursa
2. Pre- Patella bursa
3. Infra- Patella bursa
4. Semi-Membranous bursa



Q19: Mention The major ligaments in the knee joint.

1. **Patellar ligament** a continuation of the quadriceps femoris tendon distal to the patella. It attaches to the tibial tuberosity.
2. **Collateral ligaments:** are two strap-like ligaments & They act to stabilize the hinge motion of the knee, preventing excessive medial or lateral movement.
 1. **Tibial (medial) collateral ligament**
 2. **Fibular (lateral) collateral ligament**
3. **Cruciate Ligaments:** these two ligaments connect the femur and the tibia.
 1. **Anterior cruciate ligament (ACL)**– attaches at the anterior intercondylar region of the tibia to the posteromedial aspect of the lateral femoral condyle.
 2. **Posterior cruciate ligament(PCL)** – attaches at the posterior intercondylar region of the tibia anteromedial femoral condyle



Q20: Enumerate main ligaments around the knee.

1. **Patellar ligament**
2. **Collateral ligaments:**
 1. Tibial (medial) collateral ligament & 2. Fibular (lateral) collateral ligament
3. **Cruciate Ligament:**
 1. Anterior cruciate ligament & 2. Posterior cruciate ligament (PCL).

Q21: Enumerate Ankle Joint bones.

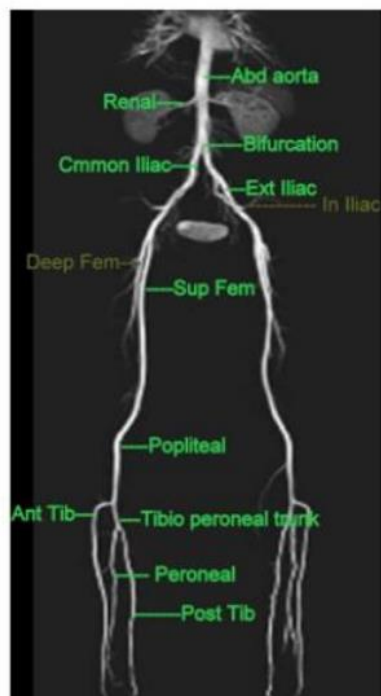
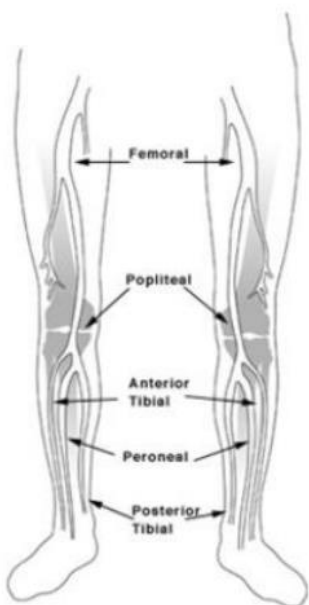
- 1- Tibia
- 2- Medial malleolus
- 3- Fibula
- 4- Lateral malleolus
- 5- Dome of talus



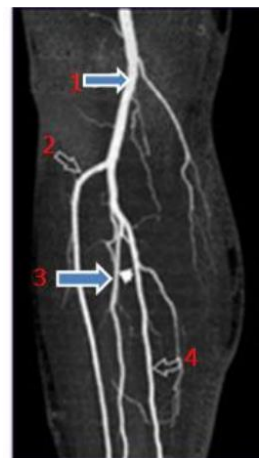
Q22: Mention articulating surfaces forming ankle joint.

- between the distal ends of the tibia and its medial malleolus of the fibula, and the trochlear surface of the talus.

Q23: Draw a diagram of lower limb arteries.



- 1- Popliteal artery
- 2- Anterior tibial artery
- 3- Peroneal artery
- 4- Posterior tibial artery



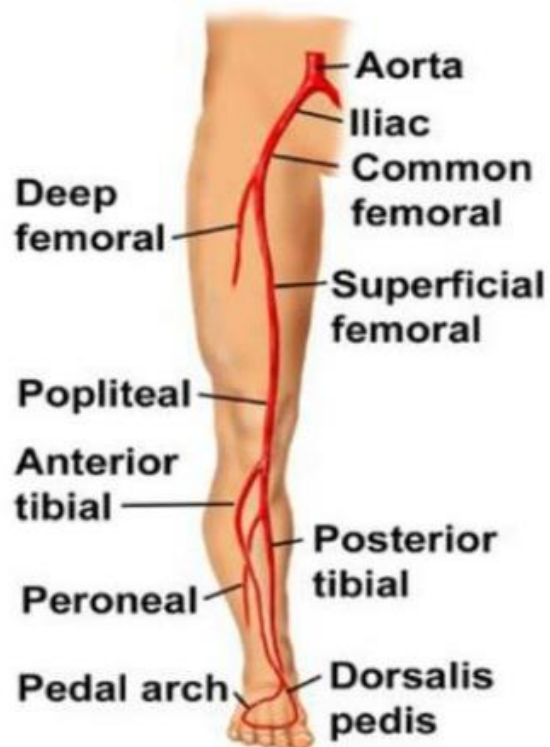
Q24: Enumerate Main lower limb Arteries.

Right & Left:

1. Common iliac artery
2. External iliac artery
3. Common Femoral artery
4. Superficial & Deep Femoral artery
5. Popliteal artery
6. Anterior & Posterior Tibial arteries
7. Tibio - peroneal trunk
8. Peroneal artery

Main arteries

- Common iliac
- External iliac
- Femoral (+ superficial/deep branches)
- Profunda femoris
- Anastomosis around knee (genicular arteries, branch of lat femoral circumflex)
- Popliteal
- Anterior/posterior tibial
- Peroneal
- Medial/lateral plantar
- Plantar arch
- Dorsalis pedis



Upper limb

Q1: Enumerate Upper limb Bones.

1. Hand
2. Arm
3. Forearm
4. Shoulder girdle.

Q2: Enumerate Upper limb joints:

1. Shoulder
2. Elbow
3. Wrist

Q3: Enumerate Upper limb Transitional zones allow passage of nerves & blood vessels.

1. Axilla
2. Antecubital fossa
3. Carpal tunnel

Q4: Enumerate Shoulder joint bones.

1. clavicle
2. scapula
3. proximal humerus

Q5: Mention Scapula anatomy.

Scapula has 4 main protuberances:

- **Coracoid process:** anteriorly
- **Glenoid Fossa:** laterally, for articulation with the humeral head
- **Spine:** posteriorly, dividing the posterior surface into supra- and infra-spinous fossae

- **Acromion Process:** forms the lateral aspect of the spine of the scapula, for articulation with clavicle.

Q6: Mention Proximal Humerus bone.

Proximal humerus (head):

- The Greater and Lesser tubercles, (Tuberosity) help to define its anatomy.
- These are separated from each other by the bicipital groove (which allows the passage of the long head of biceps tendon).

Q7: Mention Elbow Joint bones.

= Mention Articulation surfaces of Elbow joint.

- Distal humerus articular surfaces are the capitellum laterally and the trochlea medially.
- Two protuberances, the medial and lateral epicondyles & lie in an extracapsular location
- Proximal Radius: consists of the radial head, neck, and tuberosity.
- Proximal Ulna: is located medial within the forearm & consists of the olecranon and coronoid processes and the trochlear and radial notches.
 - The elbow joint consists of three articulations all enclosed by a common joint cavity:
- radio capitellar joint
- ulna trochlear joint
- proximal radio-ulnar joint

Q8: Enumerate Forearm bones.

Ulna & Radius

Hand

Q9: Mention Hand Bones.

- The *hand* consists of 27 bones, which are subdivided into:
- *Phalanges*: Bones of the digits
 - (fingers and thumb)
- *Metacarpals*: 5 Bones of the palm
- *Carpals*: Bones of the wrist arranged
- Into 2 rows
- **proximal row**
 - [scaphoid](#)
 - [lunate](#)
 - [triquetrum](#)
 - [pisiform](#)
- **distal row**
 - [trapezium](#)
 - [trapezoid](#)
 - [capitate](#)
 - [hamate](#)

Q10: Enumerate Carpal bones.

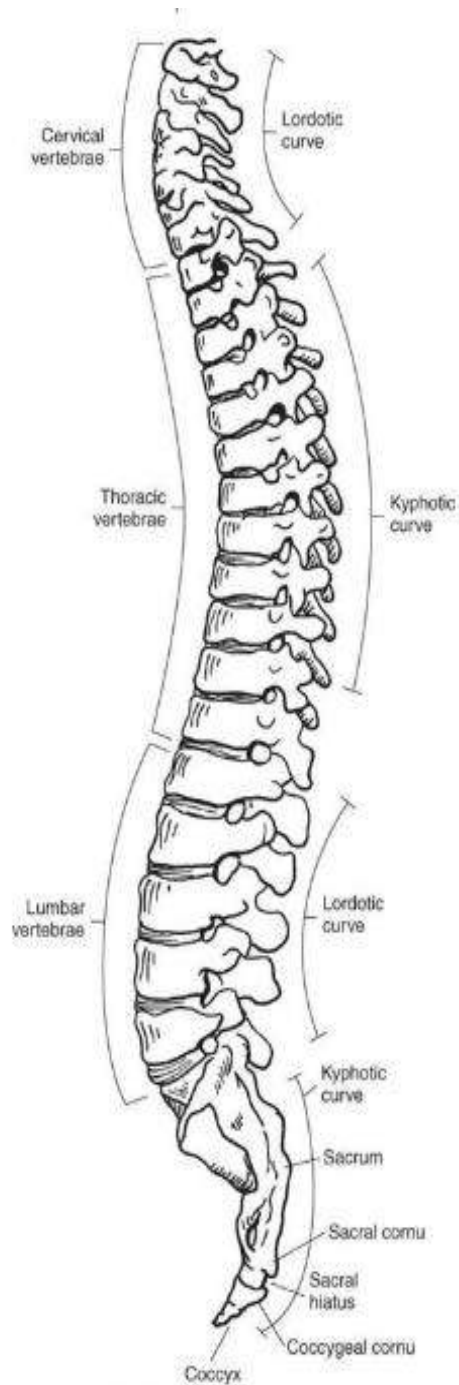
- 1.scaphoid
- 2.lunate
- 3.triquetrum
4. pisiform
- 5.trapezium
- 6.trapezoid
- 7.capitate
- 8.hamate

Q11: Enumerate Arterial Anatomy of UL.

- Subclavian A.
- Axillary A. in axilla
- Brachial A. In arm
- Radial A.in forearm
- Ulnar A. in forearm
- Palmar arches in hand

The vertebral column

- Part of axial skeleton .protects and supports
- Starts at the craniocervical junction and terminates at the tip of the coccyx.
- It comprises 7 cervical, 12 thoracic, 5lumbar, 5sacral and coccygeal (3-5 fused)vertebrae.
- Four curvatures are seen in the sagittal plane in adults:
 - cervical lordosis; from C1 to T2
 - thoracic kyphosis; from T2 to T12
 - lumbar lordosis; from L1 to L5
 - sacrococcygeal kyphosis (pelvic curvature); from the lumbosacral junction to the tip of the coccyx.



- 7 cervical
- 12 thoracic
- 5 lumbar
- 5 sacral
- coccyx



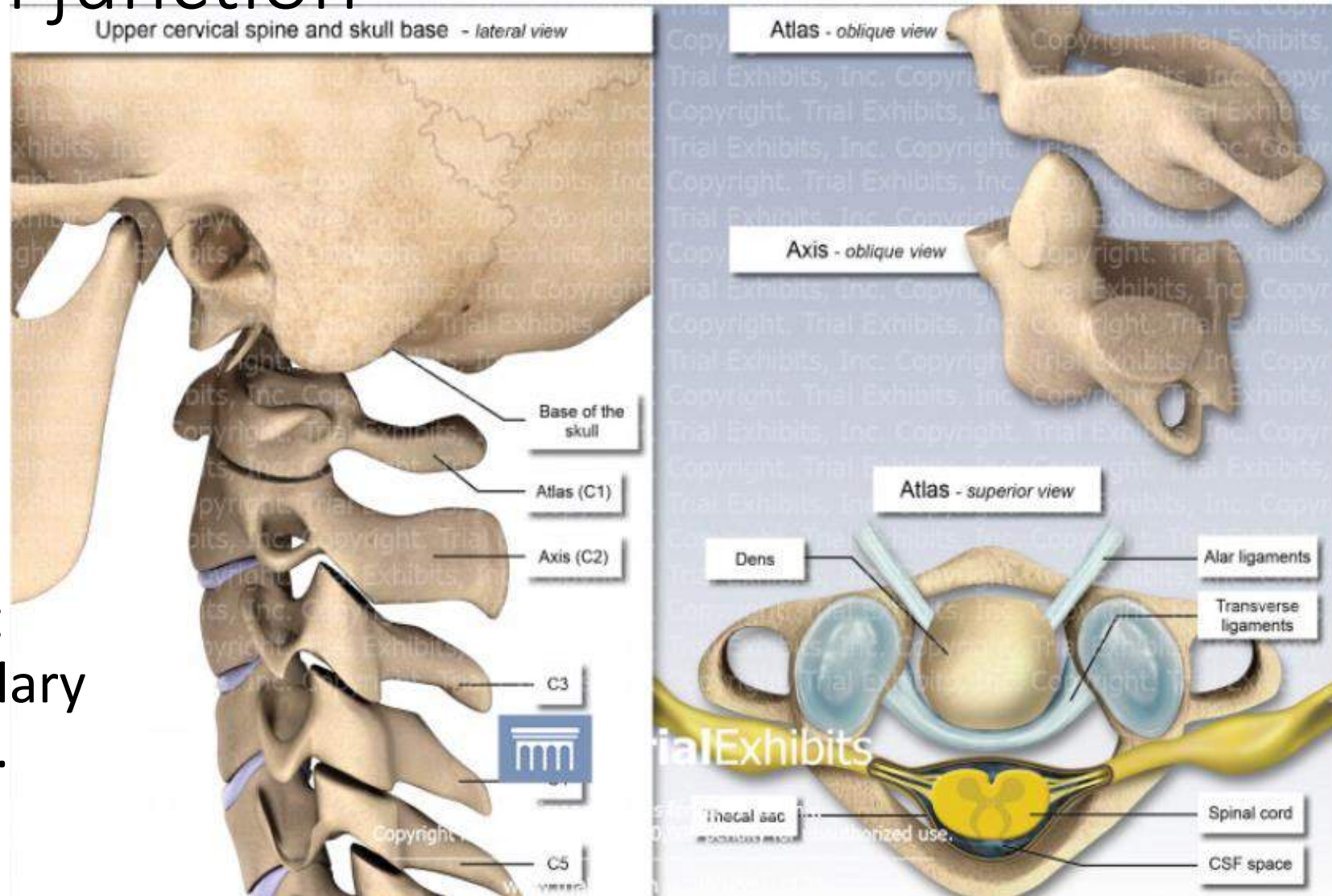
MRI SPINE



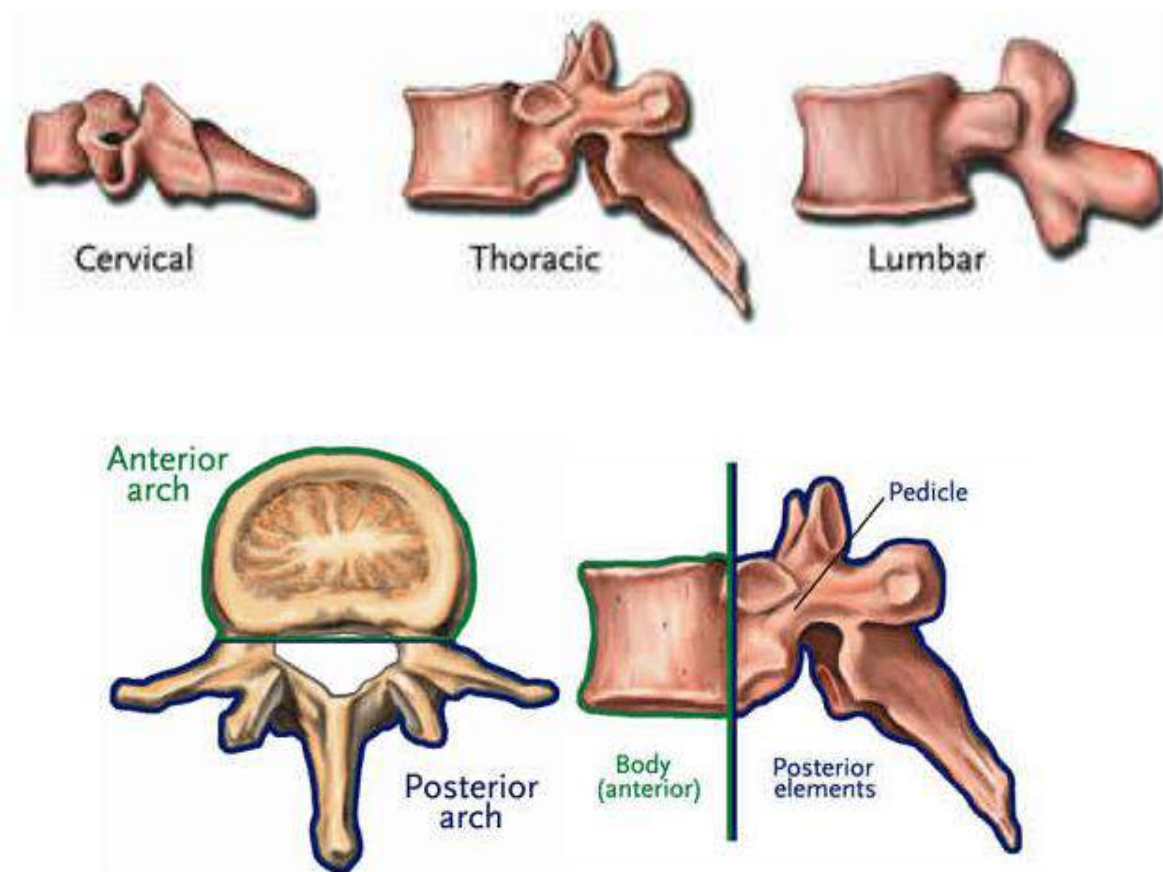
3D CT WHOLE SPINE

The cranio-cervical junction

- composed of:
 - 1-the occiput
 - 2-the atlas (C1) and
 - 3-the axis (C2),
- forming a bony canal that protects the cervicomedullary junction of the spinal cord.



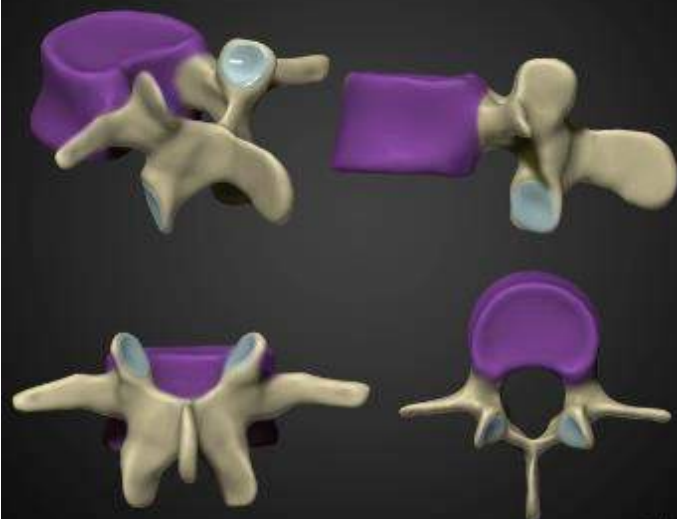
Cervical(C3-C7)-thoracic-lumbar vertebrae



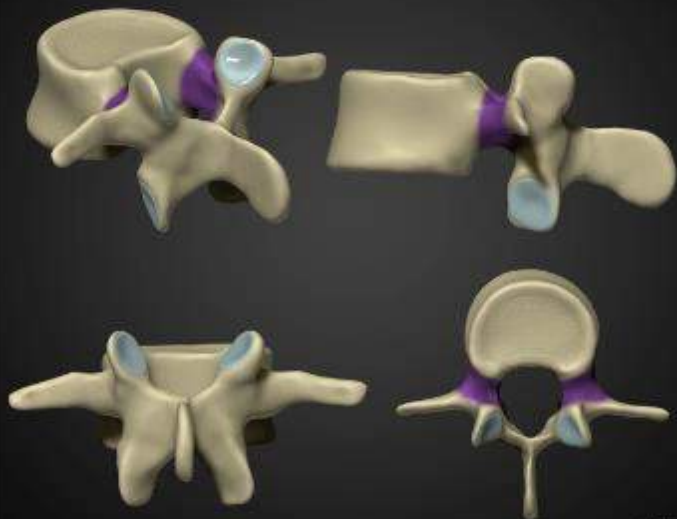
- have the same basic structures.
- Each vertebra has an anterior arch and a posterior arch, which form a hole, called a foramen. The spinal cord passes through foramen of each vertebra.
- The **anterior arch** is called the vertebral body.
- The **posterior arch** consists of the **pedicles**, **laminae**, and **processes**.



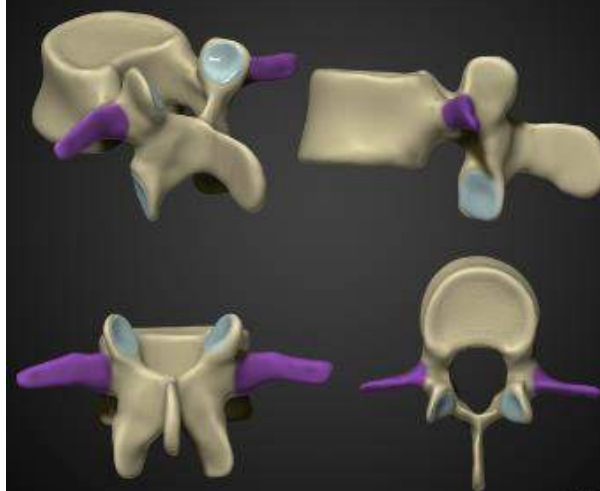
vertebral body



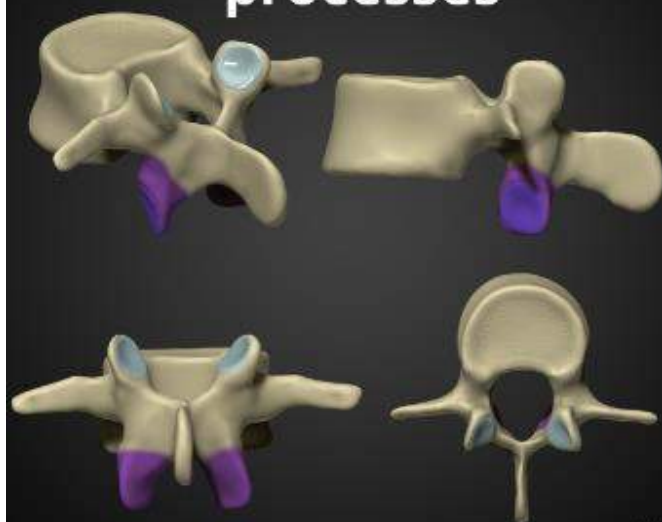
pedicles



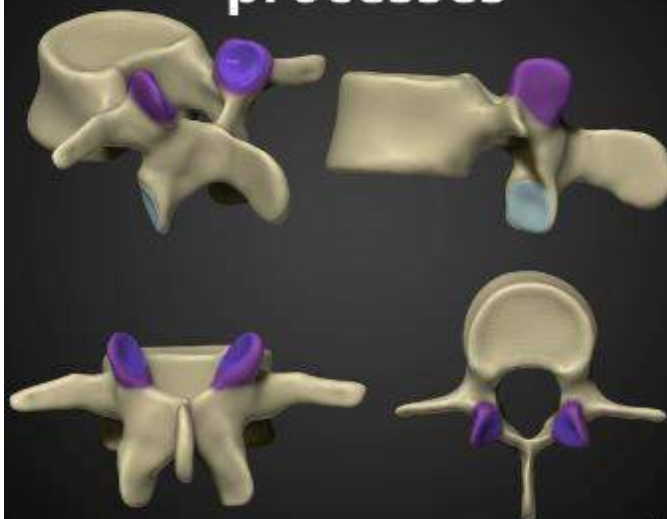
transverse processes



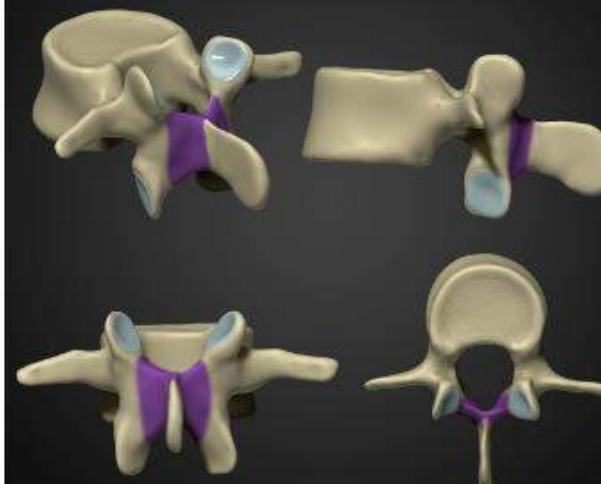
inferior articular processes



superior articular processes

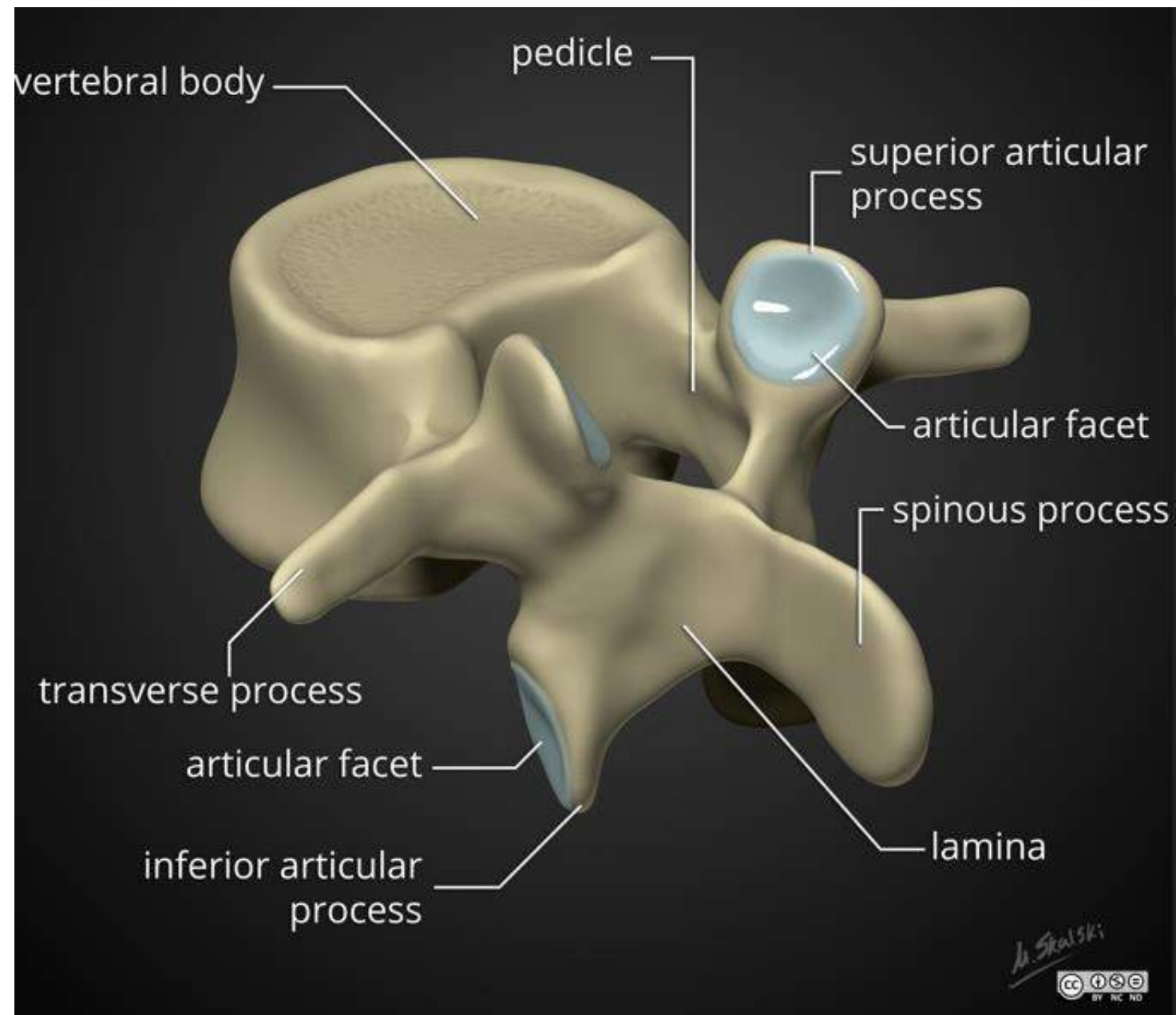



laminae

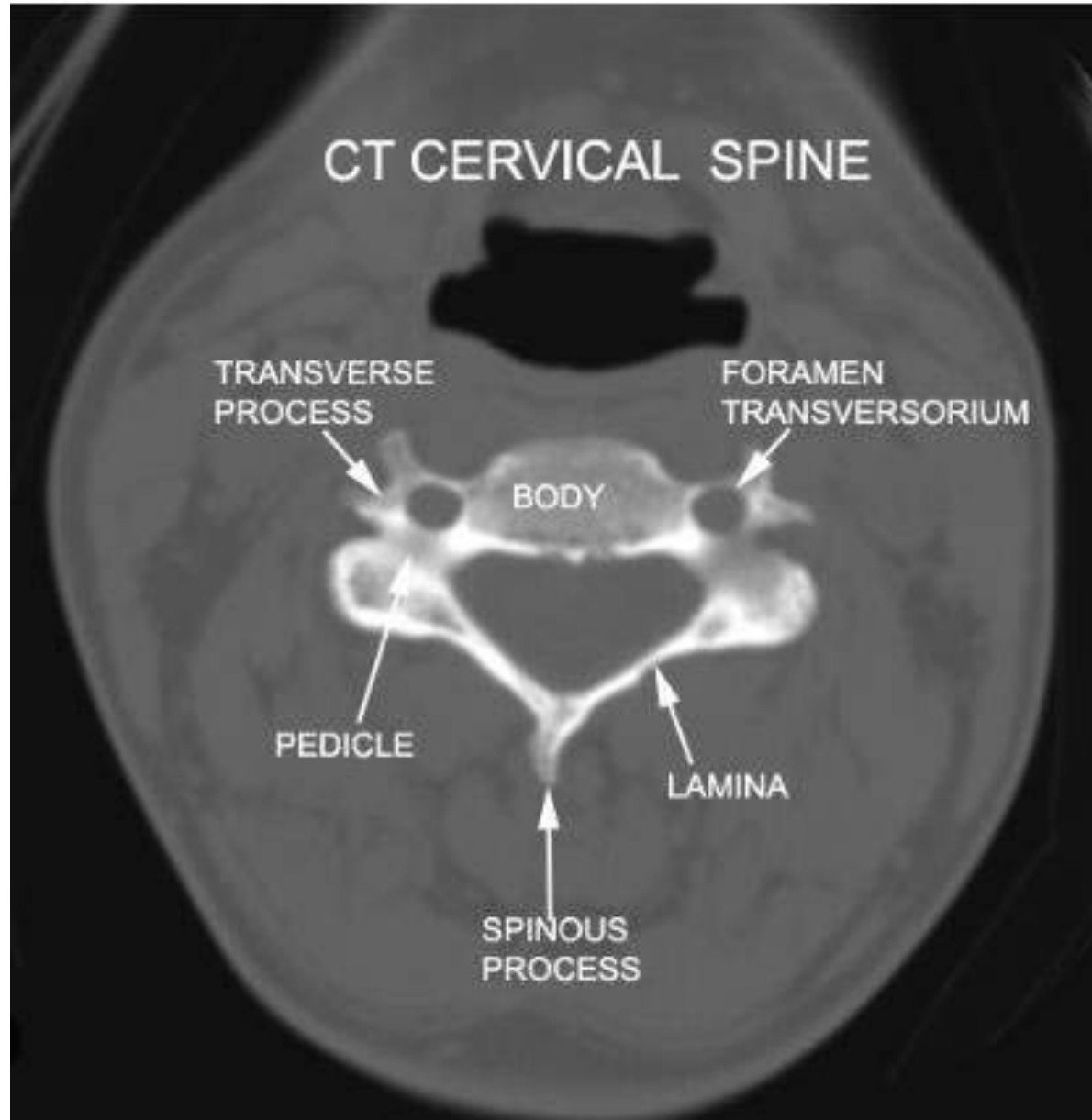


The posterior arch consists of the pedicles, laminae, and processes.

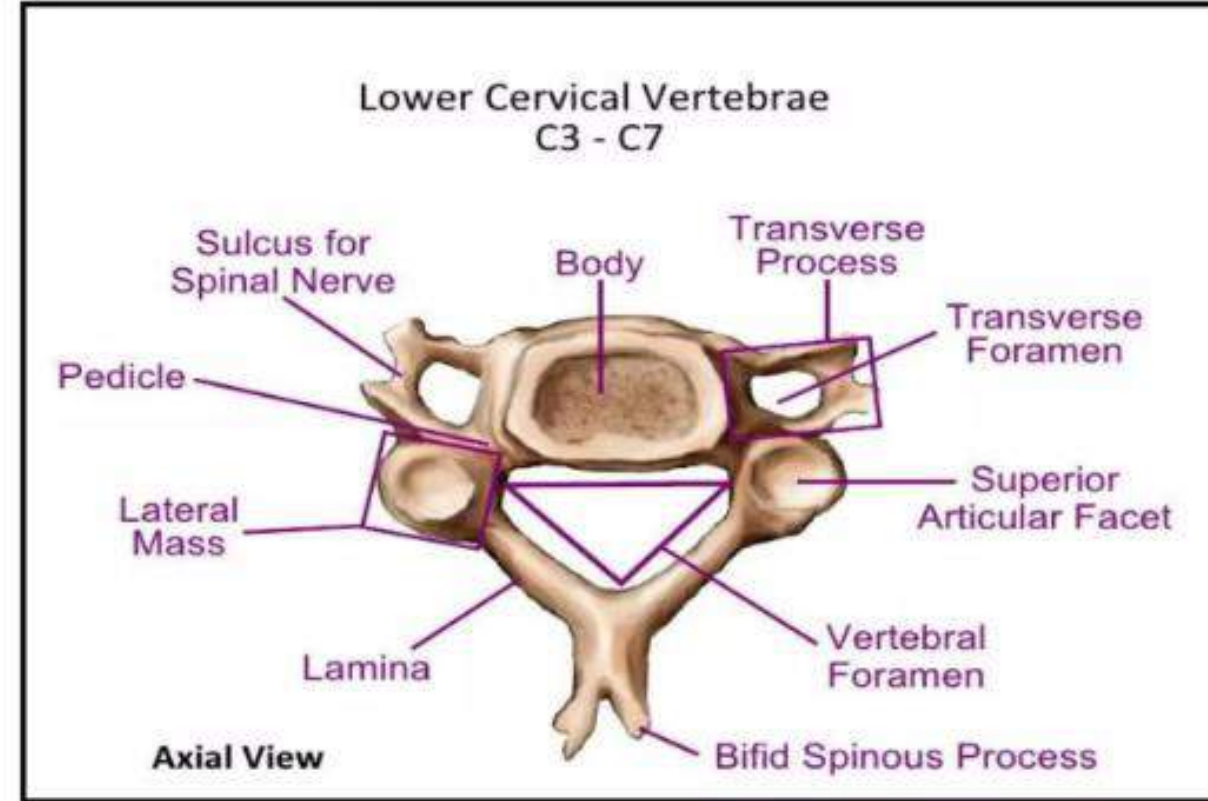
- The **pedicles** are two short cylinders of bone that extend from the vertebral body. Nerve roots branch off the spinal cord and exit to the body between the pedicles of two vertebrae. If the spine becomes unstable, the pedicles may compress the nerve root, cause pain or numbness.
- **Laminae** are two flattened plates of bone that form the walls of the posterior arch.
- The **articular, transverse,** and **spinous processes** project off the laminae. Ligaments and tendons attach to the processes. The **articular processes** join one vertebra to another posteriorly.
- The **transverse processes** extend out on either side of the laminae. The **spinous process** is the bony projection that can be felt through the back of someone's skin.



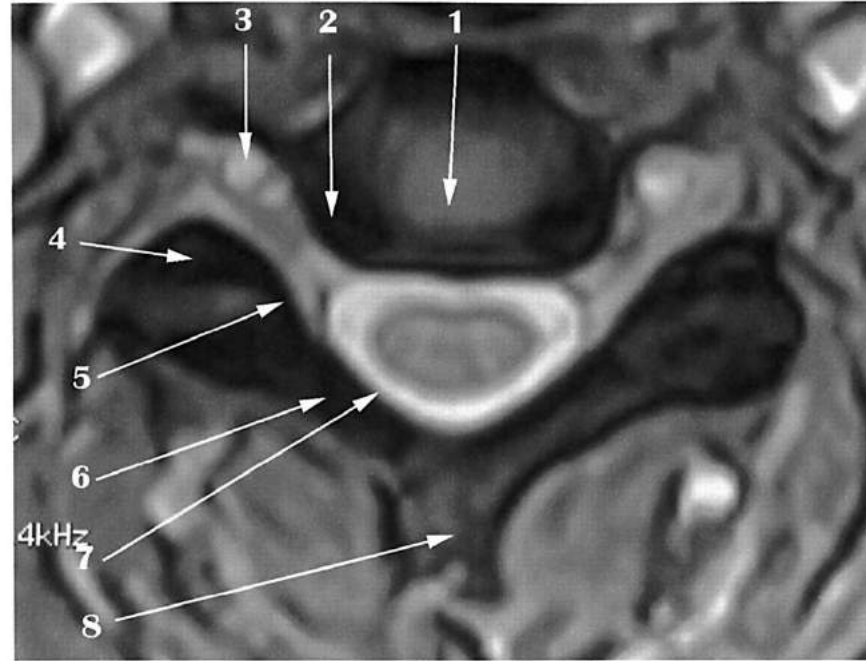
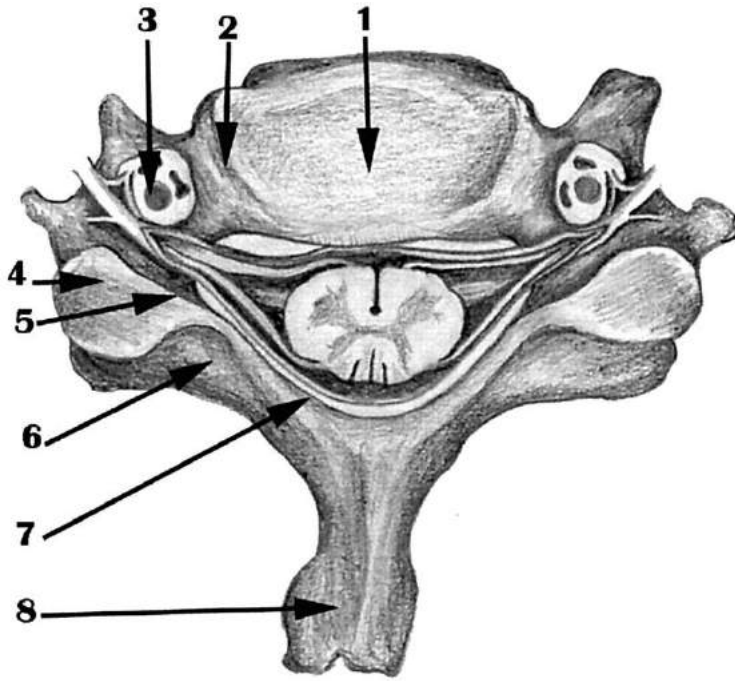
CHARACTERISTIC	CERVICAL	THORACIC	LUMBAR
Overall structure			
Size	Small.	Larger.	Largest.
Foramina	One vertebral and two transverse.	One vertebral.	One vertebral.
Spinous processes	Slender, often bifid (C2–C6).	Long, fairly thick (most project inferiorly).	Short, blunt (project posteriorly rather than inferiorly).
Transverse processes	Small.	Fairly large.	Large and blunt.
Articular facets for ribs	Absent.	Present.	Absent.
Direction of articular facets			
Superior	Posterosuperior.	Posterolateral.	Medial.
Inferior	Anteroinferior.	Anteromedial.	Lateral.
Size of intervertebral discs	Thick relative to size of vertebral bodies.	Thin relative to size of vertebral bodies.	Thickest.



NORMAL CERVICAL MRI ANATOMY



Axial cervical spine anatomy.



(1) Anterior vertebral body endplate. (2) Uncus (constituting one side of uncovertebral joint). (3) Vertebral artery within foramen transversarium. (4) Lower facet. (5) Medial aspect of facet joint. (6) Lamina. (7) Site of attachment ligamentum flavum. (8) Spinous process.

Facet joints

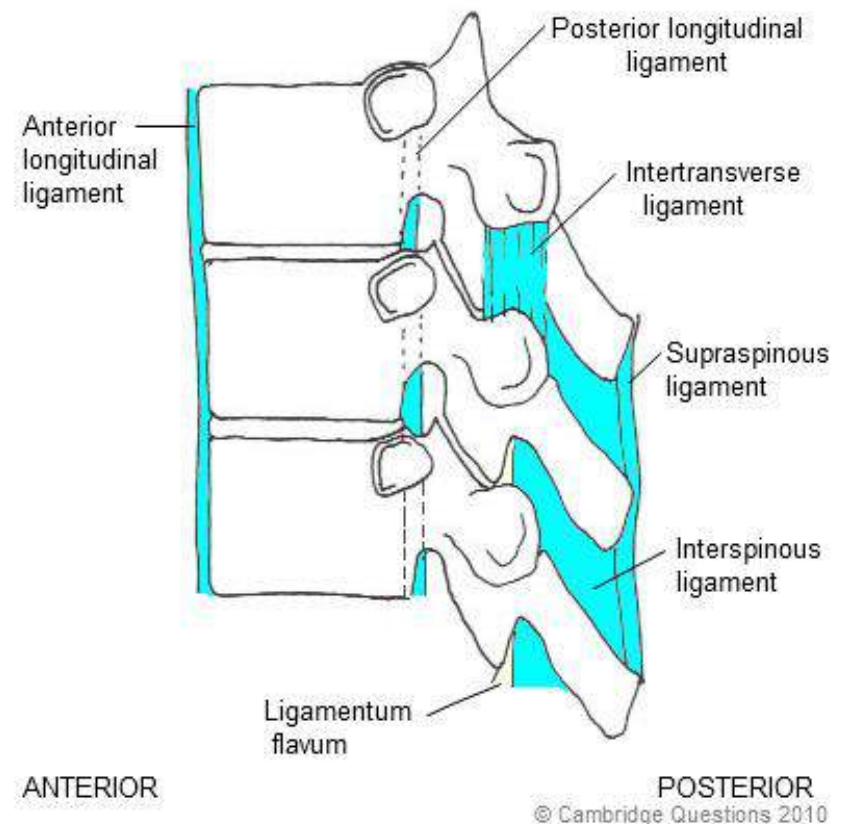
- They are symmetrical synovial-lined joints with a [fibrous capsule](#) that connect the articular facets of the vertebrae.
- The facet joints are formed by two articular processes of adjacent vertebrae, with the superior articular process of one vertebra located immediately anterior to the inferior articular process of the vertebra below.
- The facets joints however do demonstrate some regional variation in orientation and morphology

Intervertebral discs

- **Intervertebral discs** form the articulations between adjacent vertebral bodies from [C2](#) to [S1](#), thus forming 23 in total .
- the IVD functions to provide motion between individual vertebrae and also allows the effective transfer of load .
- Each intervertebral disc is comprised of:
 - peripheral [annulus fibrosus](#)
 - central [nucleus pulposus](#)
- Above and below the intervertebral disc are the [vertebral body endplates](#).

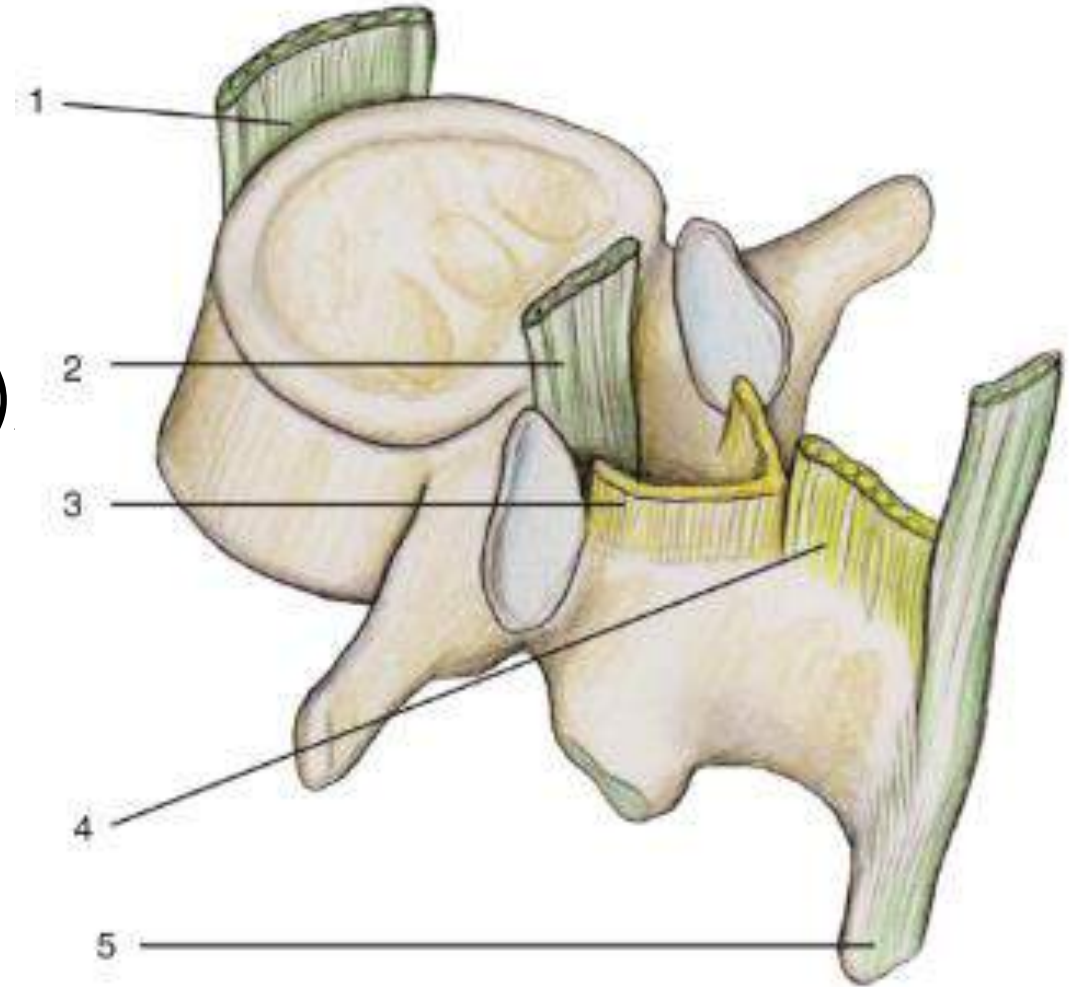
Spinal ligaments

- The spinal ligaments are important stabilizers of the vertebral column and, being made of fibrous tissue, appear as thin black stripes on all MRI pulse sequences.
- Main ligaments of spine:
 - Anterior longitudinal ligament
 - Posterior longitudinal ligament
 - Ligamentum Flavum.
 - Supraspinous ligament.
 - Interspinous ligament.

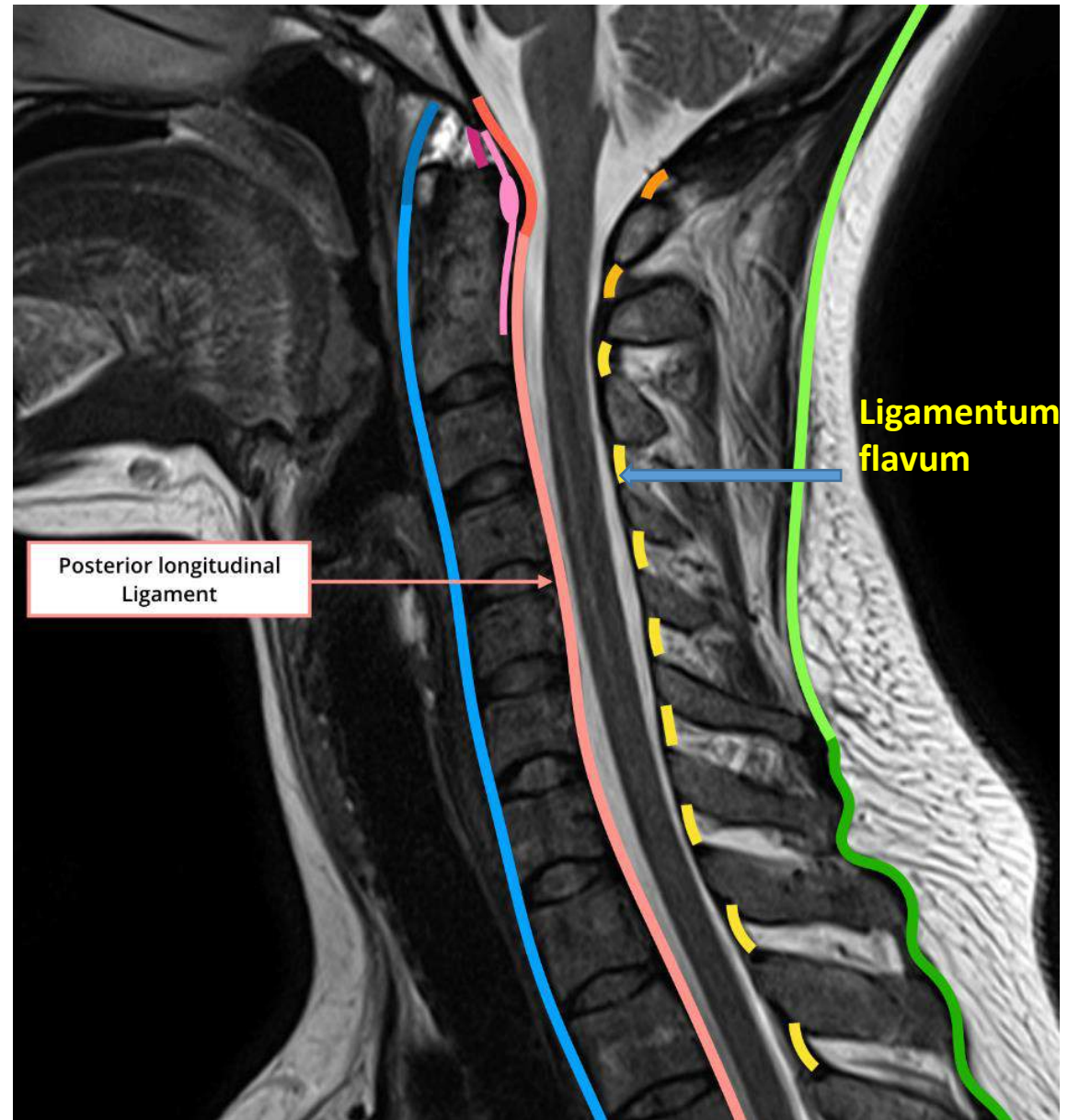
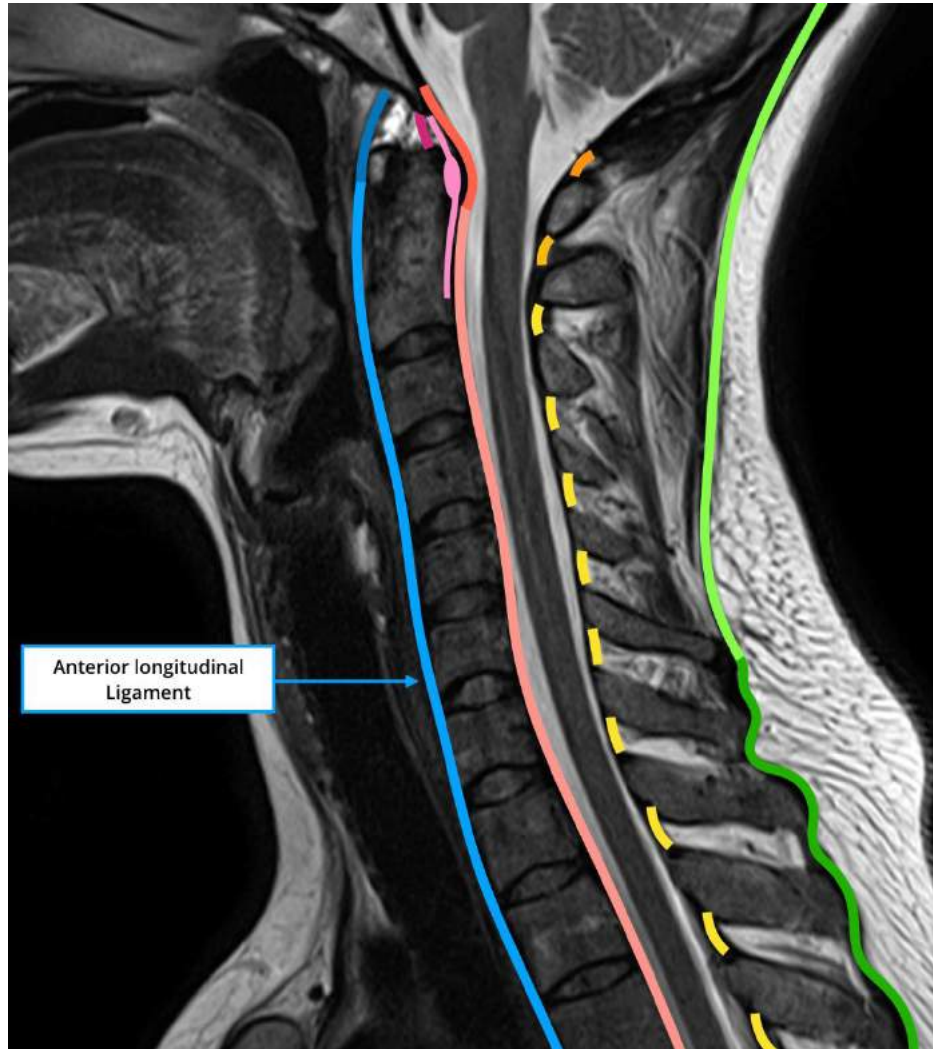


- The anterior longitudinal ligament (ALL) and posterior longitudinal ligament (PLL) both arise at the skull base and extend continuously downward, attaching to the front and back of the sacrum:
- the ALL runs anterior to the vertebral bodies and discs, being firmly attached to the anterior annulus
- the PLL runs posterior to the vertebral bodies and discs, being wider at the disc space and being firmly attached to the posterior annulus

- (1) Anterior longitudinal ligament (ALL);
- (2) Posterior longitudinal ligament (PLL)
- (3) ligamentum flavum;
- (4) Inter-spinous ligament;
- (5) Supra-spinous ligament;



Spinal ligaments



Spinal Canal

- The **spinal canal**, also known as the **vertebral canal**, is the cavity within the [vertebral column](#) that contains the thecal sac and [spinal cord](#).
- The canal consists of a series of vertebral foramina (the holes at The spinal canal becomes progressively narrower from its superior opening at the [foramen magnum](#) to its inferior opening at the [sacral hiatus](#) .
- The spinal cord occupies the superior two-thirds of the spinal canal and terminates at L1/L2 vertebral body.
- The canal has a typical shape depending on its level:
 - [cervical](#): small and triangular
 - [thoracic](#): small and round
 - [lumbar](#): large and triangular (anterior of the vertebra) linked with discoligamentous structures.

Spinal Canal

- **Boundaries**

- anterior: [vertebral bodies](#), [intervertebral discs](#), [posterior longitudinal ligament](#)
- posterior: [ligamentum flavum](#) lining the laminae
- lateral: [vertebral pedicles](#) .

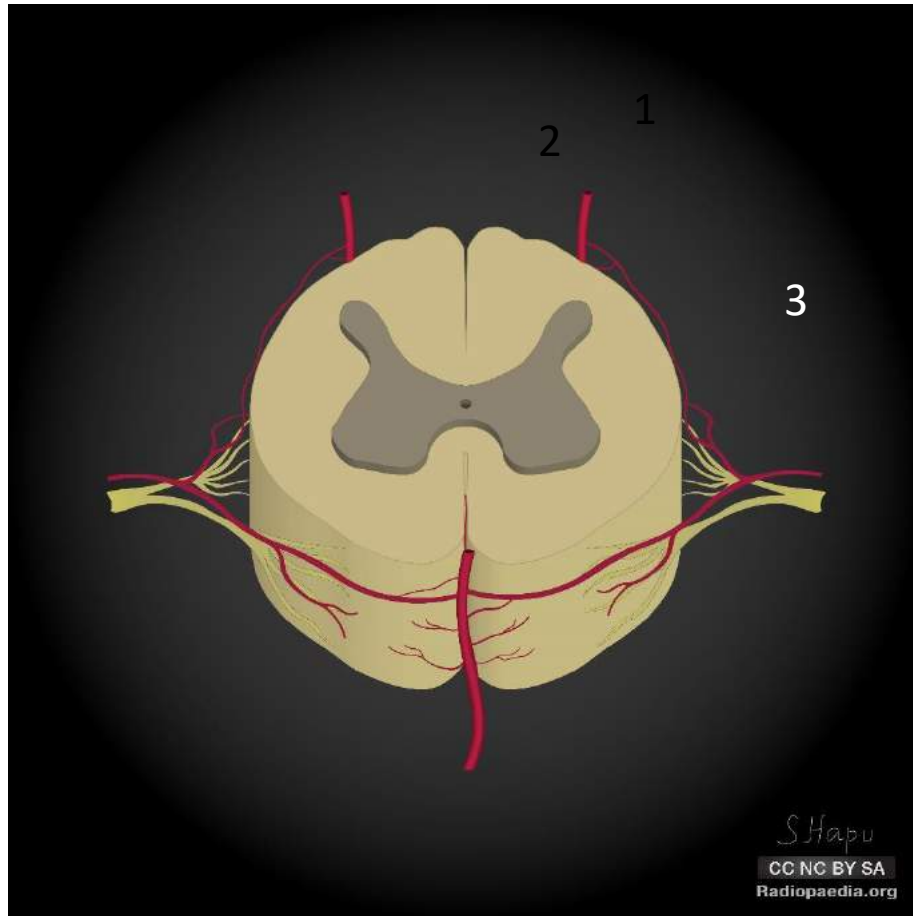
- **Contents...filled with CSF**

- [spinal meninges](#)
- spinal cord with its associated nerve roots and vessels.
- [epidural space](#)

Spinal Cord

- The **spinal cord** is the part of the [central nervous system](#) found within the vertebral column's spinal canal. The cord extends from the corticomedullary junction at the [foramen magnum](#) of the skull down to the tip of the conus [medullaris](#) within the [lumbar cistern](#). It is lined by the [spinal pia mater](#) and contained by the other [spinal meninges](#) in the thecal sac.
- The spinal cord measures approximately 42-45 cm in length, ~1 cm in diameter .
- it is composed of [grey](#) and [white matter](#). However, unlike the brain, the grey matter is on the internal aspect of the cord, and the [white matter tracts](#) are external.
- Throughout its length, paired dorsal and ventral nerve roots enter its dorsolateral and ventrolateral surface, respectively.

Spinal Cord



- 1-White matter.
- 2- Gray matter (H shape).
- 3-Nerve root



Spinal Cord

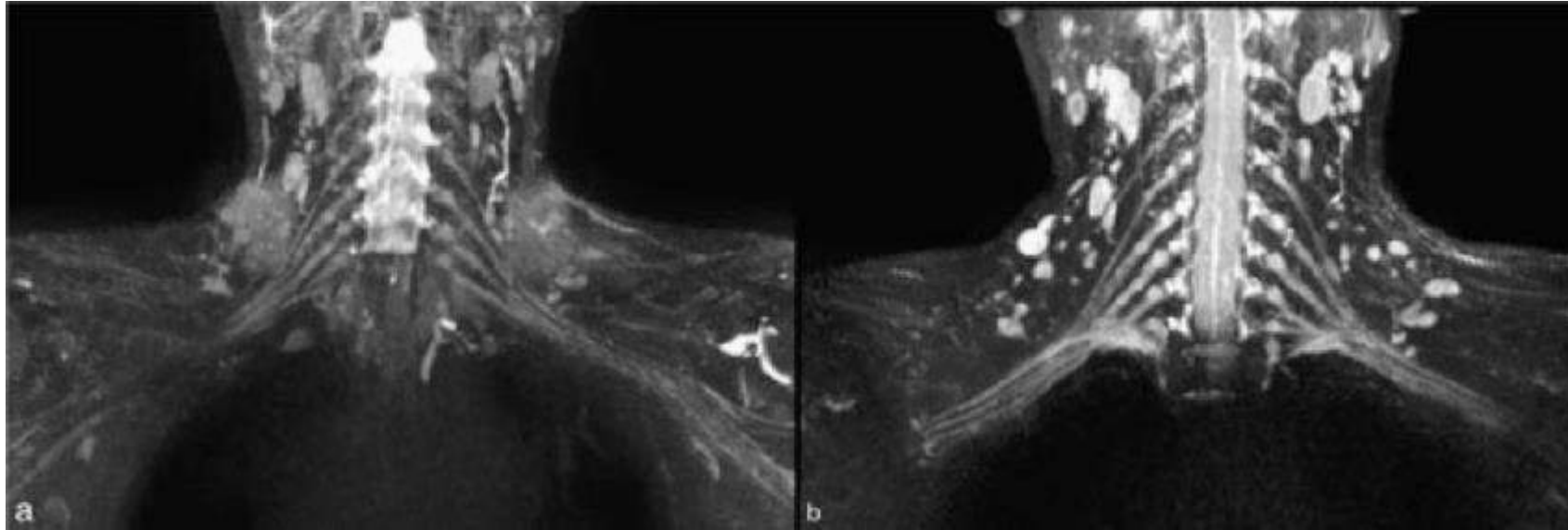
T2WI-sagittal MRI

1- spinal cord

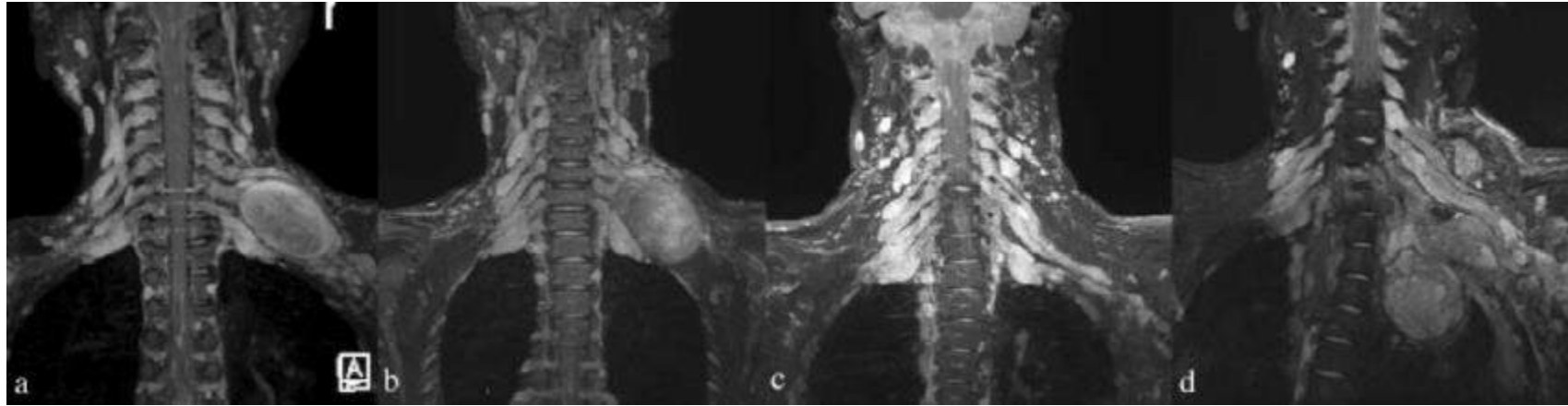
2-Conus medullaris.

3-Filum terminale

Spinal Nerve plexus



- a) Classical three-dimensional VISTA sequence in comparison with (b) the optimized improved motion-sensitized driven equilibrium sequence.

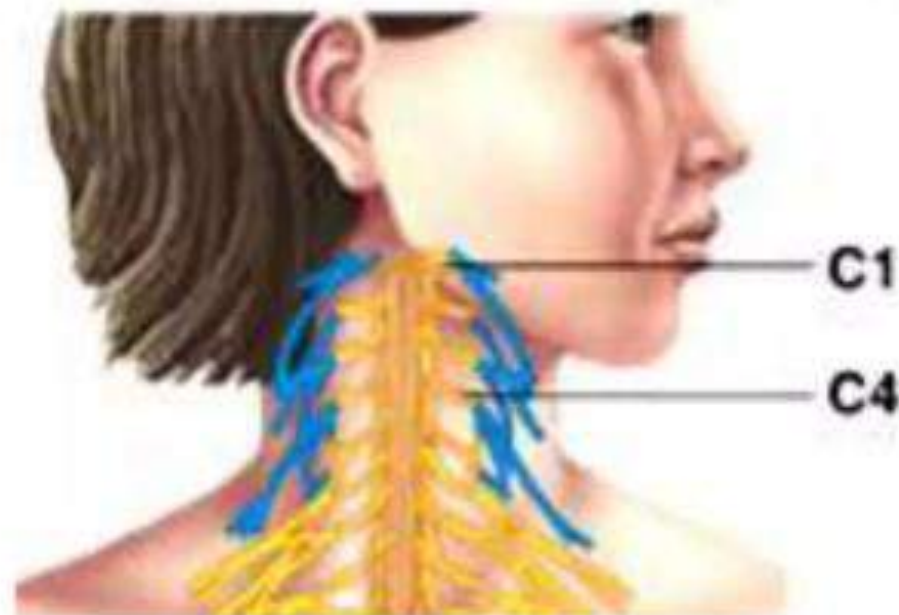


Malignant degeneration of a plexiform neurofibroma in patient with neurofibromatosis (NF) type I. (a) Note the large irregular and polylobulated bilateral brachial plexus roots in a patient with NF type I. (b) The lesion of the left C7 root increased in size and became heterogeneous 6 months later. (c) MRI obtained 3 months after surgical removal shows a residual lesion (asterisk). (d) The lesion then presented important growth with pleural invasion (d).

Nerve plexus

- ▶ Complex network of ventral primary divisions of spinal nerves
- ▶ Four large plexuses
 - Ventral rami of C1–C4= **cervical plexus**
 - Ventral rami of C5–T1= **brachial plexus**
 - Ventral rami of L1–L4= **lumbar plexus**
 - Ventral rami of L4–S4= **sacral plexus**

Cervical Plexus



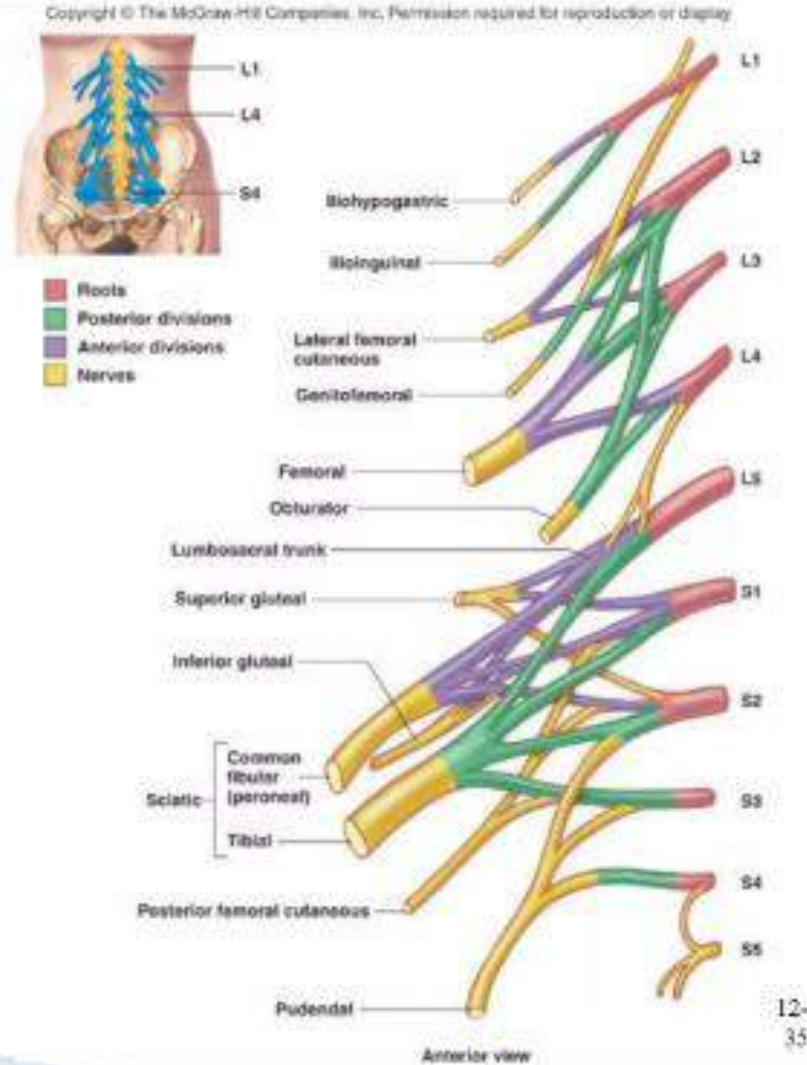
- ▶ C1–C4
- ▶ Innervates superficial neck structures, skin of neck, posterior portion of head
- ▶ Ansa cervicalis: loop between C2 and C3
- ▶ Phrenic nerve
 - From C3–C5 (cervical and brachial plexuses)
 - Innervate diaphragm

Brachial Plexus

- ▶ Nerve plexus of C5– C8 and T1
- ▶ Five ventral rami form three **trunks** that separate into six **divisions** then form **CORDS** that give rise to:
- ▶ **Branches / nerves**
 - Axillary
 - Radial
 - Musculocutaneous
 - Ulnar
 - Median
 - Smaller nerves such as pectoral, long thoracic, thoracodorsal, subscapular, suprascapular

Lumbosacral Plexus

- ▶ Lumbar plexus: ventral rami of L1–L4
- ▶ Sacral plexus: ventral rami of L4–S4
- ▶ Usually considered together because of their close relationship
- ▶ Four major nerves exit and enter lower limb
 - Obturator
 - Femoral
 - Tibial
 - Common fibular (peroneal)



Vertebral column

1. What are numbers of vertebrae in each part of vertebral column

- 7 cervical
- 12 thoracic
- 5 lumbar
- 5 sacral
- coccyx (3-5)

2. What are curvatures of the vertebral column.

- Four curvatures are seen in the sagittal plane in adults:
 - **cervical lordosis**; from C1 to T2
 - **thoracic kyphosis**; from T2 to T12
 - **lumbar lordosis**; from L1 to L5
 - **sacrococcygeal kyphosis** (pelvic curvature); from the lumbosacral junction to the tip of the coccyx.



3. Enumerate parts of the craniocervical junction

- 1-the occiput
- 2-the atlas (C1) and
- 3-the axis (C2)

4. Enumerate the basic structure of the vertebra.


- Each vertebra has an **anterior arch** and a **posterior arch**, which form a hole, called a foramen. The spinal cord passes through foramen of each vertebra.
- The **anterior arch** is called the **vertebral body**.
- The **posterior arch** consists of the **pedicles, laminae, and processes**.

5. Enumerate parts of the posterior arch of vertebrae

- The **posterior arch** consists of the **pedicles, laminae, and processes**.

6. Compare between cervical and dorsal vertebrae

7. Compare between dorsal and lumbar vertebrae

CHARACTERISTIC	CERVICAL	THORACIC	LUMBAR
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Inferior	Anteroinferior.	Anteromedial.	Lateral.
Size of intervertebral discs	Thick relative to size of vertebral bodies.	Thin relative to size of vertebral bodies.	Thickest.

8. Mention bones forming facet joints

- **The facet joints are formed by two articular processes of adjacent vertebrae, with the superior articular process of one vertebra located immediately anterior to the inferior articular process of the vertebra below.**
-

9. Mention structures forming intervertebral discs

- Each intervertebral disc is comprised of:
 - peripheral **annulus fibrosus**
 - central **nucleus pulposus**
- Above and below the intervertebral disc are the **vertebral body endplates**.

Spinal cord

1. Mention function of spinal ligaments and enumerate their names.

- The spinal ligaments are important **stabilizers of the vertebral column**
- Main ligaments of spine:
 - **Anterior longitudinal ligament**
 - **Posterior longitudinal ligament**
 - **Ligamentum Flavum.**
 - **Supraspinous ligament.**
 - **Interspinous ligament.**

2. Mention contents of spinal canal.

- The canal consists of a series of vertebral foramina (the holes at The spinal canal becomes progressively narrower from its superior opening at the **foamen magnum** to its inferior opening at the **sacral hiatus**).

3. How the shape of the spinal canal defines its level

- **Cervical**: small and triangular
 - **Thoracic**: small and round
 - **Lumbar**: large and triangular (center of the vertebra) linked with discoligamentous structures.
-

4. Mention extent of spinal cord

- The cord extends from the **corticomedullary junction** at the **foramen magnum** of the skull down to the tip of the **conus medullaris** within the **lumber cistern**.

Cross Sectional Anatomy Basics



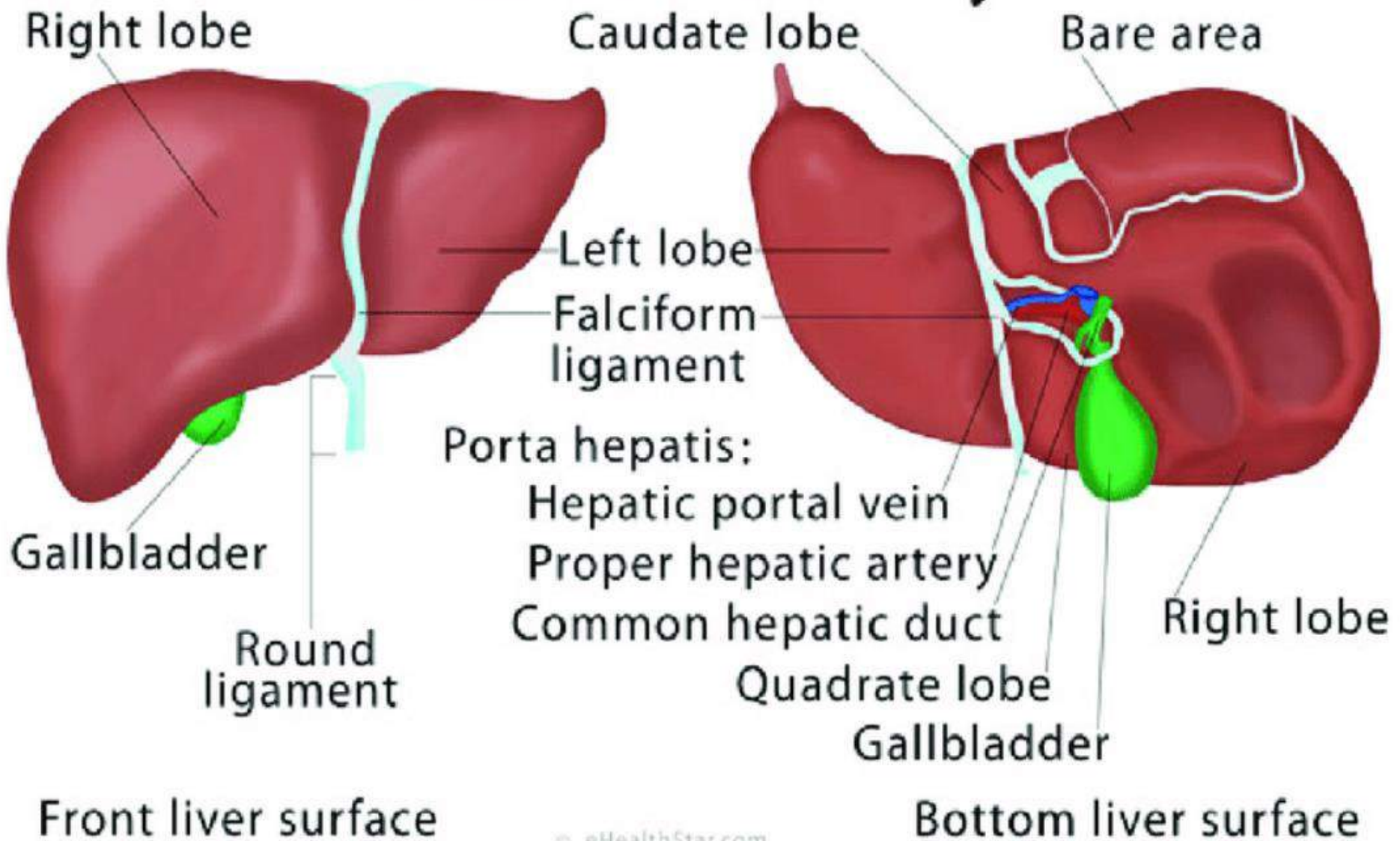
- The ability to see inside the human body for medical Purposes started in 1895 ,when Wilhelm Conrad Roentgen discovered **x-rays**.
- Medical imaging has evolved from the static2-dimensional (**2D**) image of the first x-ray to the 2D cross-section image of computed tomography(**CT**), and finally to the 3-dimensional (**3D**) imaging techniques used today.
- Sectional anatomy emphasizes the physical relationship between internal structures.

Comparison of Traditional Anatomy and Sectional Anatomy



- The traditional approach to anatomy is to study an entire organ.
- In sectional anatomy, the anatomy is viewed on what is commonly called a slice of the body .
- Visualization of an entire organ may require several sequential slices.
- Sophisticated imaging equipment can take the information from the slices and create a three-dimensional (3D) image.
- Correct orientation is critical to proper identification of structures.

Liver Anatomy



The importance of cross-sectional anatomy



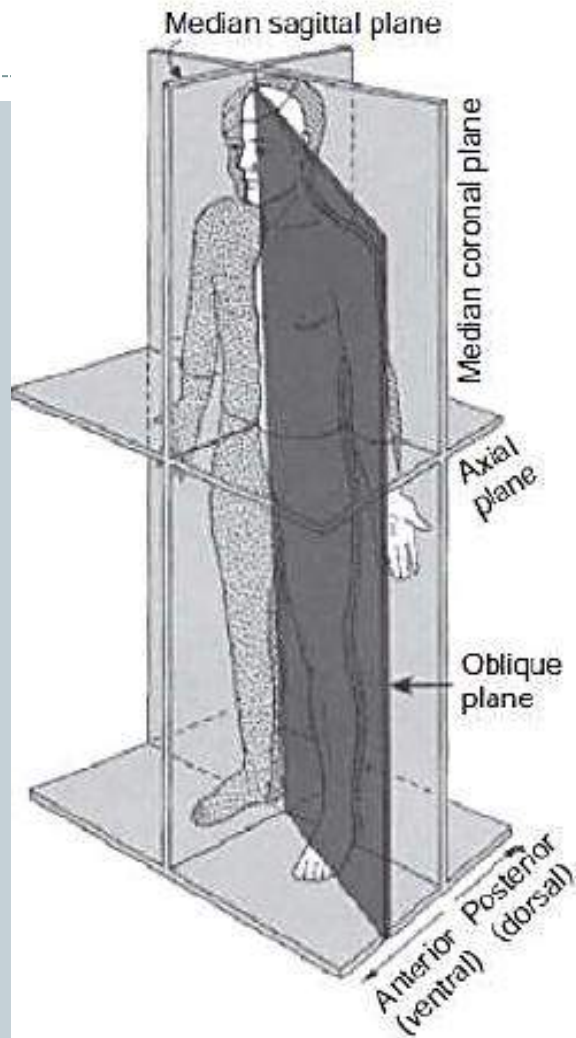
- The knowledge of the appearances and relationships of anatomical structures in transverse and vertical section help in precise diagnosis, as well as the detailed planning of therapy



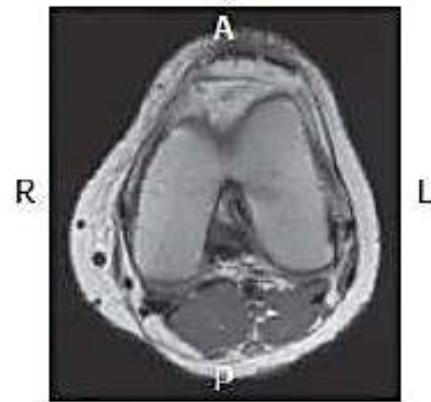
- **cautionary notes for learning sectional anatomy:**
 - 1. A given organ varies in appearance at different levels in the same individual.**
 2. Every individual is different, and even images of the same individual taken at the same level differ because of breathing and in voluntary movements.
 - 3. The key is understanding, not memorization**

Anatomic positions and planes:

- **In anatomic position**, the body is standing erect, face and toes pointing forward, and arms at the side with the palms facing forward.
- **Sectional images** are acquired and displayed according to one of the four fundamental anatomic planes that pass through the body.



Sagittal



Transverse



Coronal

Two Vertical Planes:

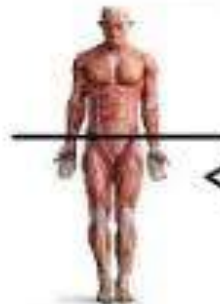


↔ Sagittal Plane



↔ Frontal (or Coronal) Plane

One Horizontal Plane:



↔ Transverse (or Horizontal) Plane

One "Odd" Angle Plane:



↔ Oblique Plane

Sagittal Plane

It runs vertically from top to bottom, and it divides the body into a left and right portion.

Midsagittal Plane

If the sagittal plane runs directly down the midline of the body, it is called a "midsagittal plane" or median plane.

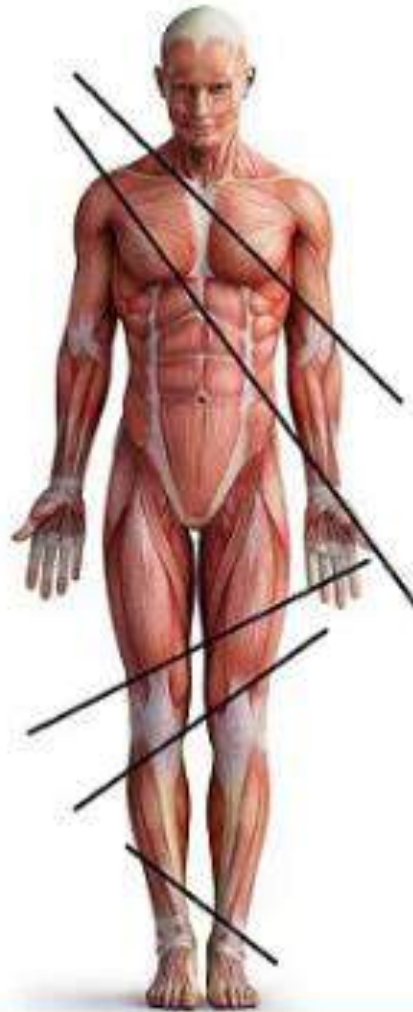
Sagittal planes that are uneven (not down the midline) are called parasagittal planes.

Parasagittal Plane



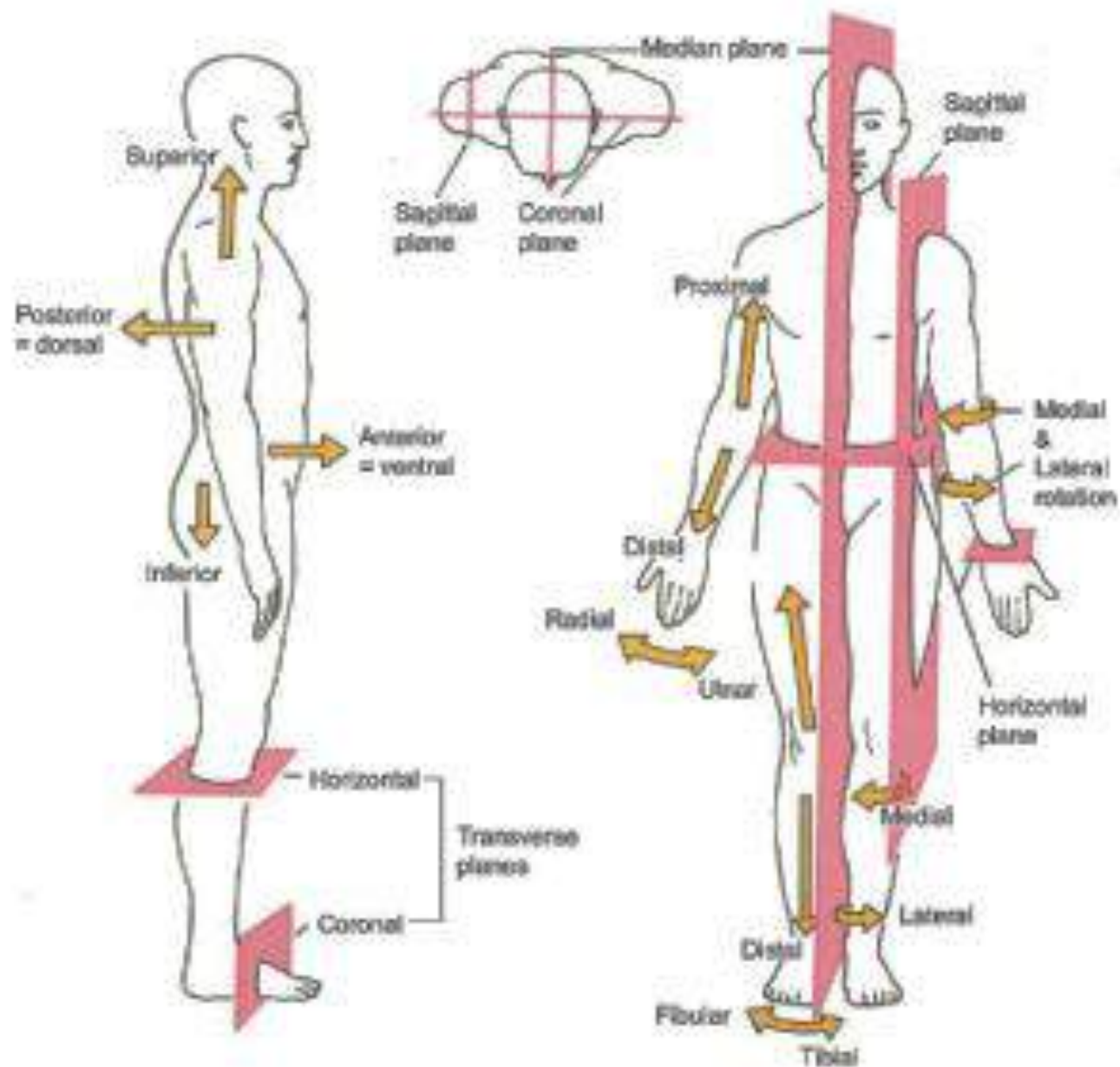
Oblique Planes

a plane that is any type of angle other than horizontal or vertical angle.



“oblique” means that something is not parallel or a right angle. An easy way to remember this is to remember “obliques are odd angles.”





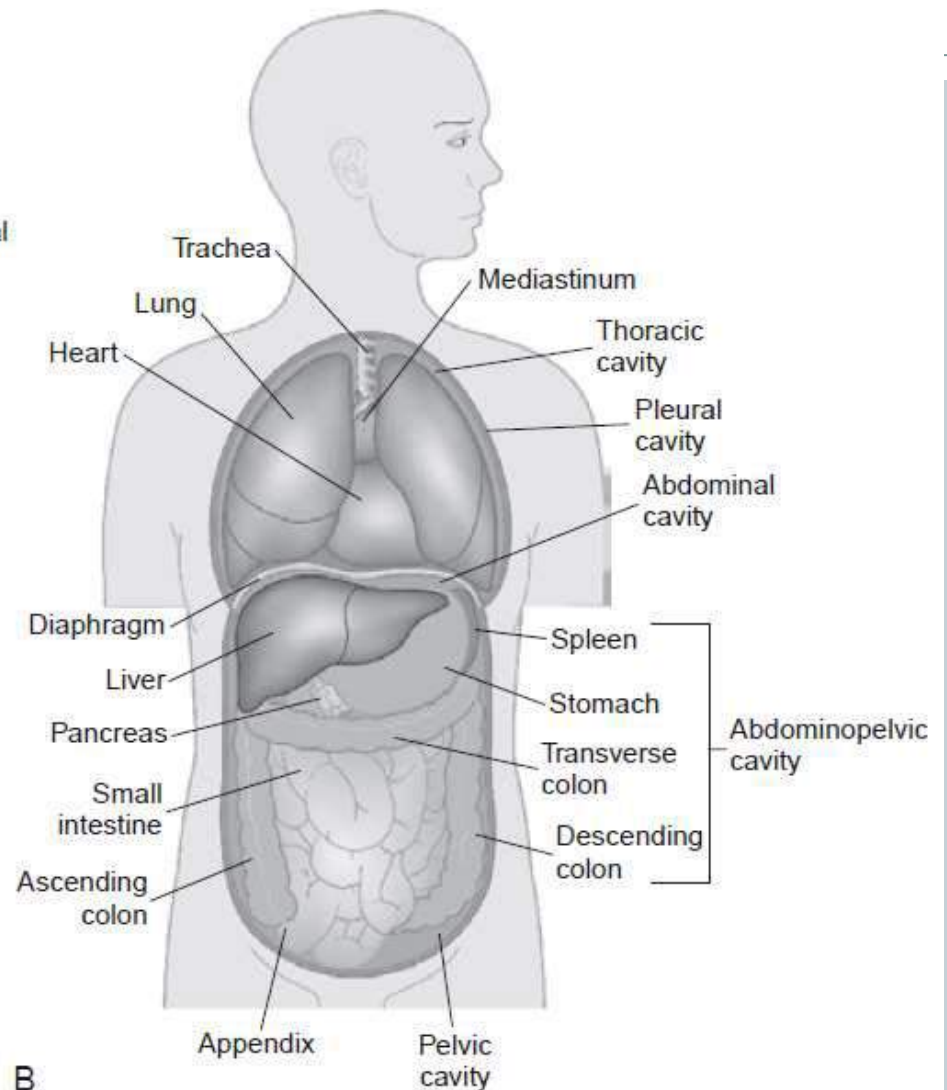
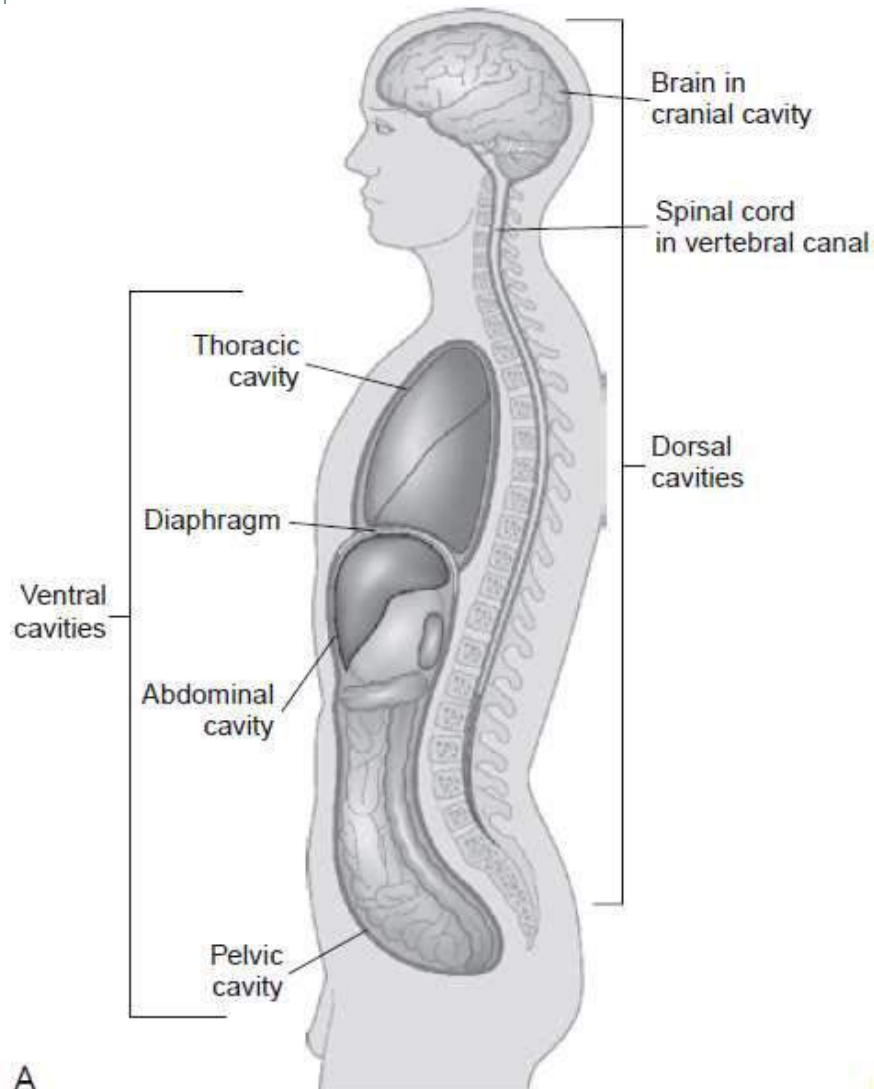
The four anatomic planes are defined as follows:

1. **Sagittal plane:** a vertical plane that passes through the body, dividing it into right and left portions.
2. **Coronal plane:** a vertical plane that passes through the body, dividing it into anterior (ventral) and posterior (dorsal) portions.



3. **Axial (transverse) plane:** a horizontal plane that passes through the body, dividing it into superior and inferior portions
4. **Oblique plane:** a plane that passes diagonally between the axes of two other planes

Body cavities



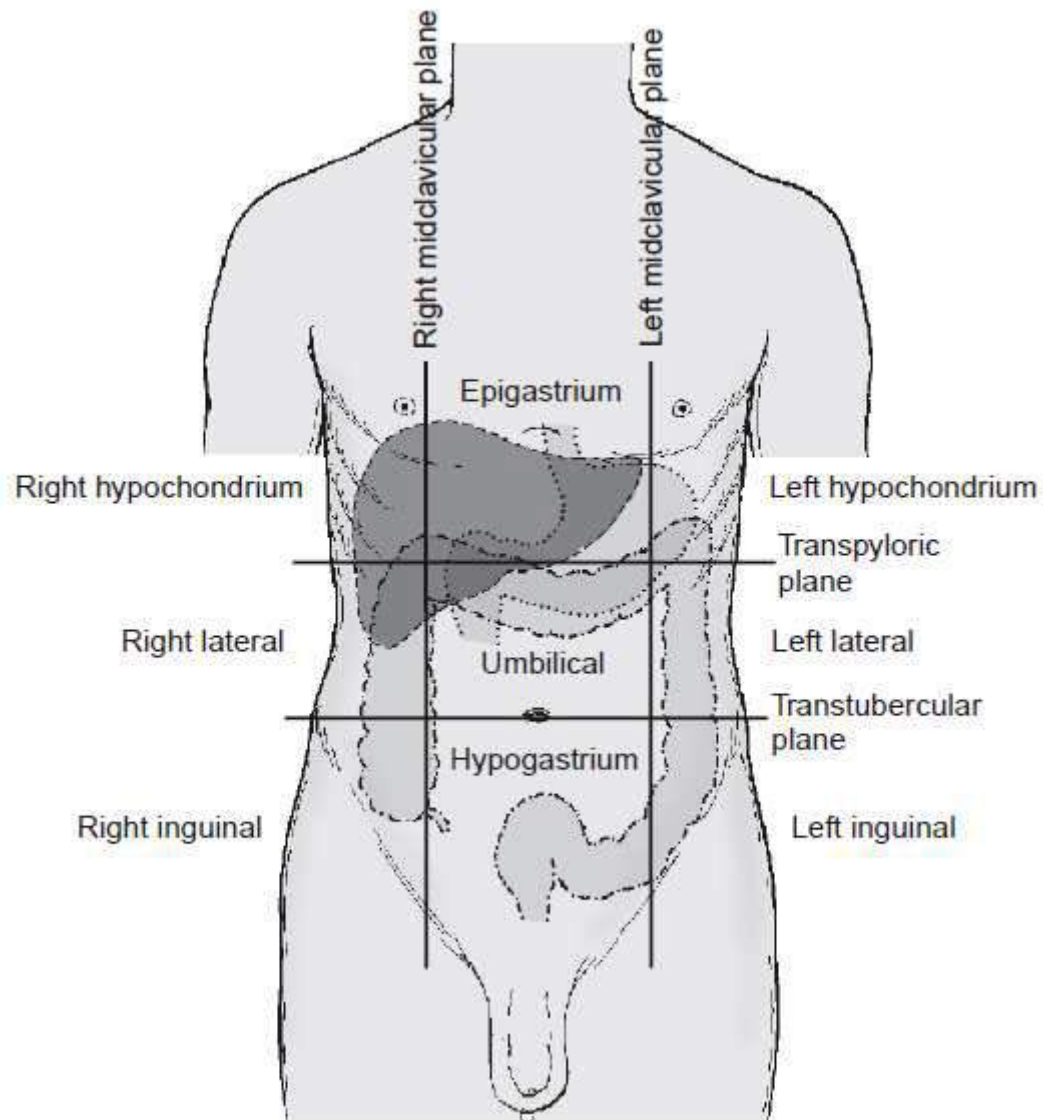
Sagittal view of body cavities.

Anterior view of body cavities.



The body consists of two main cavities:

- **1.The dorsal cavity:**is located posteriorly and includes the cranial and spinal cavities.
- **2.The ventral cavity:**the largest body cavity, is subdivided into the thoracic and abdominopelvic cavities.
 - The thoracic cavity is further subdivided into **two lateral pleural cavities** and **a single**, centrally located cavity called **the mediastinum**.
 - The abdominal cavity can be subdivided into **the abdominal** and **pelvic cavities**.





- The abdomen can be further divided **by four planes** into **nine regions**.
- The two horizontal planes are **the transpyloric and transtubercular planes**.
- **The transpyloric plane** is found midway between the xiphisternal joint and the umbilicus, passing through **the inferior border of the L1 vertebra**.



- **The transtubercular plane** passes through the tubercles on the iliac crests, at the level of **the L5 vertebral body**.
- The two sagittal planes are **the midclavicular lines**.
- Each line runs inferiorly from **the midpoint of the clavicle** to **the midinguinal point**.



The nine regions can be organized into three groups:

1. Superior:

Right hypochondrium.

Epigastrium.

Left hypochondrium.

2. Middle:

Right lateral.

Umbilical.

Left lateral.

3. Inferior:

Right inguinal.

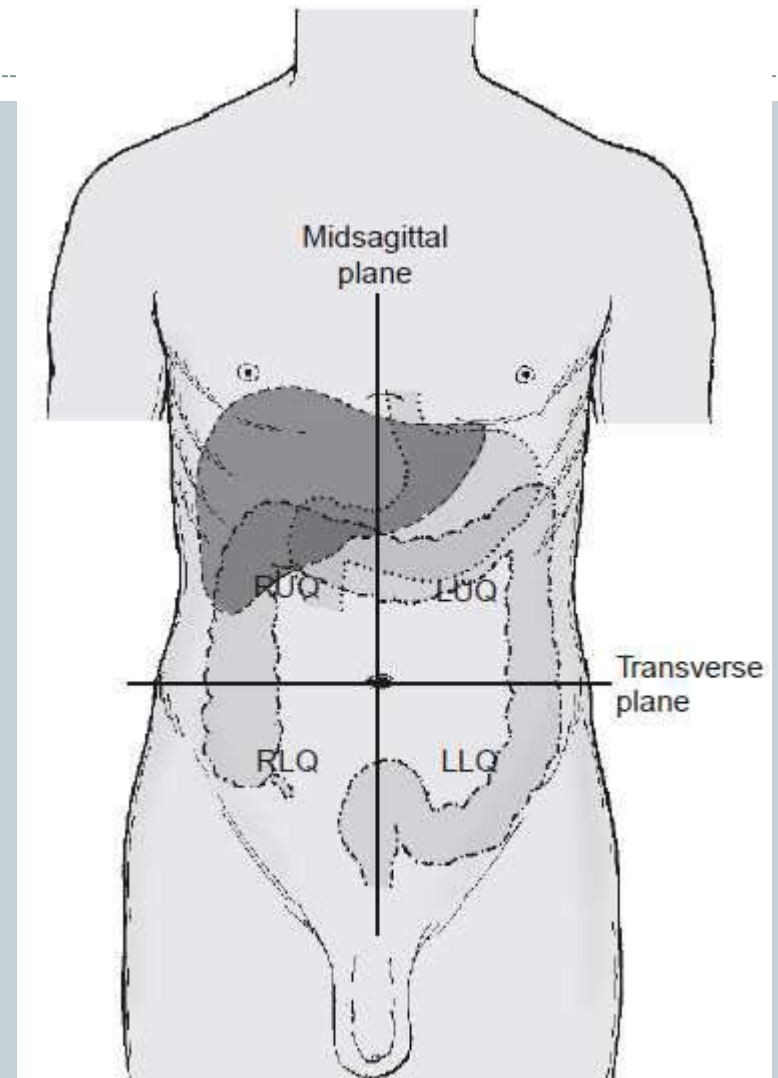
Hypogastrium.

Left inguinal

Quadrants:

- The **midsagittal plane** and **axial plane** intersect at the umbilicus to divide the abdomen into four quadrants:

- 1.Right upper quadrant (**RUQ**).
- 2.Right lower quadrant (**RLQ**).
- 3.Left upper quadrant (**LUQ**).
- 4.Left lower quadrant (**LLQ**).



- **Orientation of sections and images:**

- In a **transverse (axial) slice**, imagine that the patient is supine and you are standing at the person's feet looking up into the patient's body.

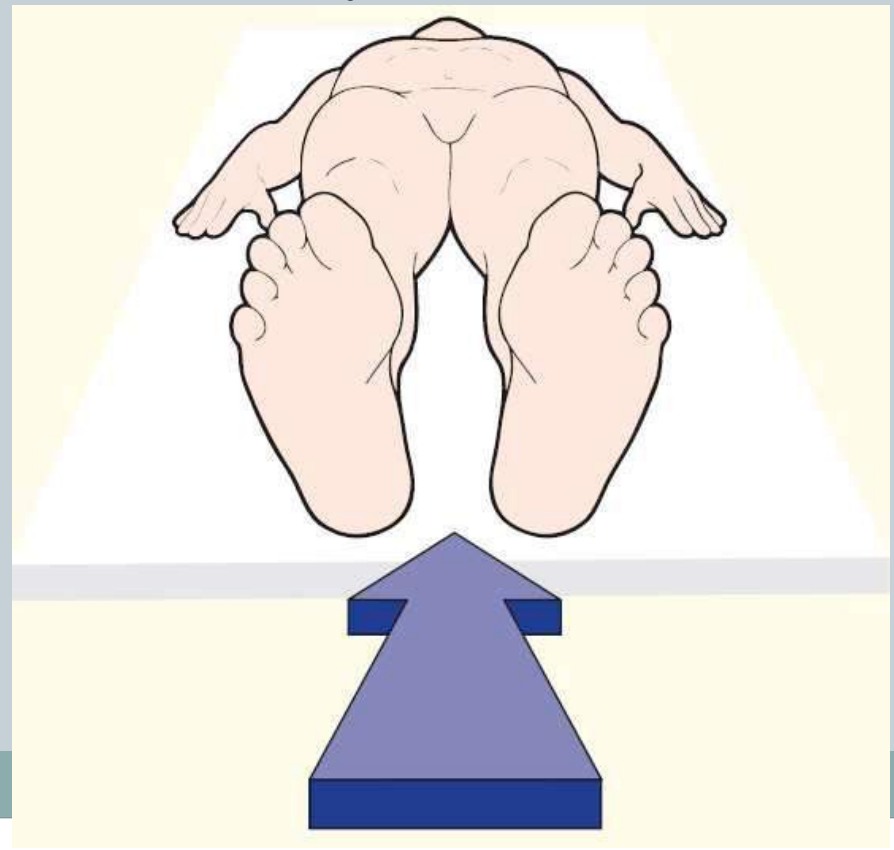
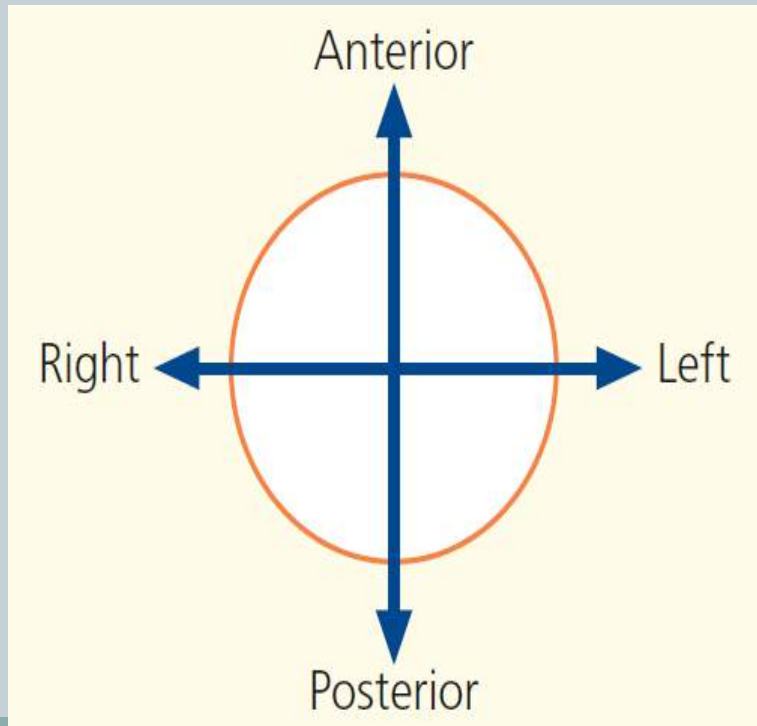


Image display



- Each **digital Image** can be divided into individual regions called **pixels** or **voxels** that are then assigned a numerical value corresponding to a specific tissue property of the structure being imaged.
- The numerical value of each voxel is assigned a **shade of gray** for image display



- **In CT**, the numerical value (**CTnumber**) is referenced to a Hounsfield unit (**HU**), which represents the attenuating properties or density of each tissue.
- **Water** is used as the reference tissue and is given a value of zero.



- A **CT number** greater than zero will represent tissue that is denser than water and will appear in progressively **lighter shades** of gray to white.
- Tissues with a negative **CT number** will appear in progressively **darker shades** of gray to black.

Gray scale display

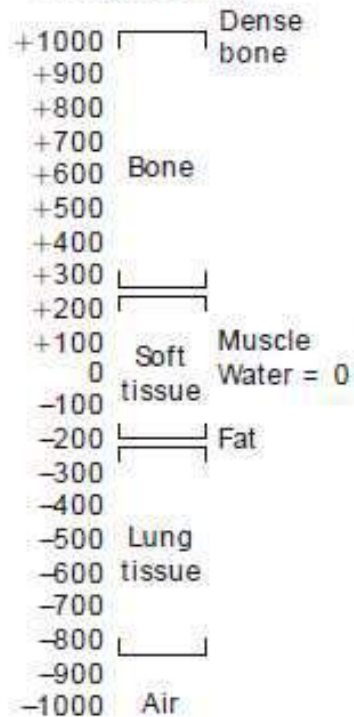


White

256
gray
shades

Black

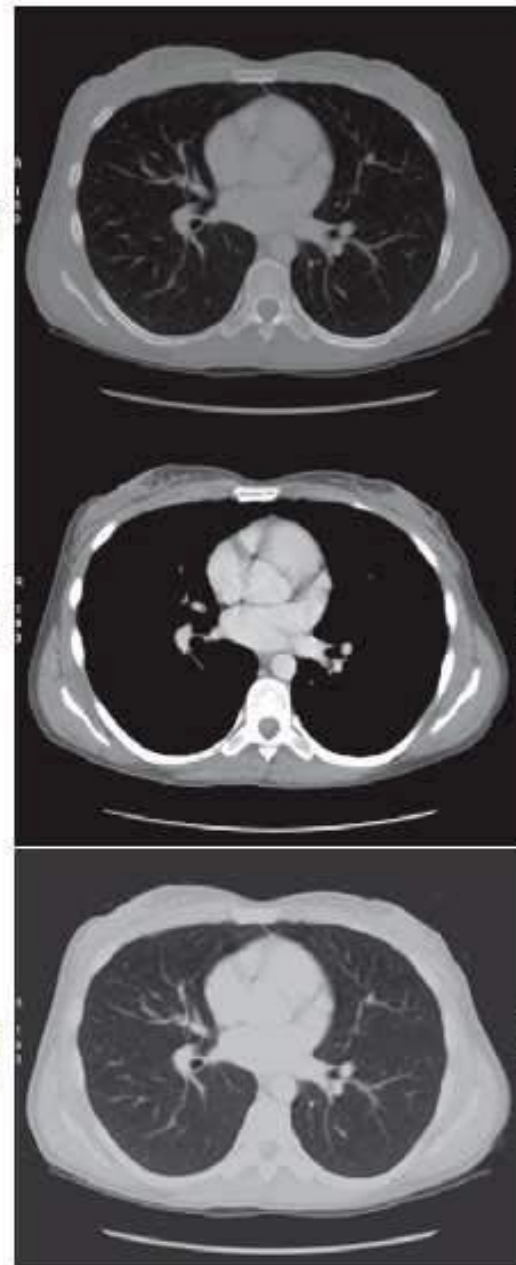
CT number (HU)



Mediastinal window

Bone window

Lung window



WW 2000
WL 250

WW 350
WL 50

WW 1500
WL -500

CT numbers and windowing on axial CT of chest

3D Imaging



- **Shaded Surface Display (SSD):**

- only information from the surface of an object.
- The voxels located on the edge of a structure are used to show the outline or outside shell of the structure

- **Maximum Intensity Projection (MIP):**

- The MIP selects only the voxel with the highest value for inclusion in the displayed image.

- **Volume Rendering (VR):**

- All voxels contribute to the image.
- This allows VR images to display multiple tissues and show their relationships to one another.
- The pixels in the final VR image can be assigned a color, brightness, and degree of opacity.

MRI



- **In (MRI)**, the gray scale represents the specific tissue relaxation properties of **T₁** ,**T₂**, and proton density.